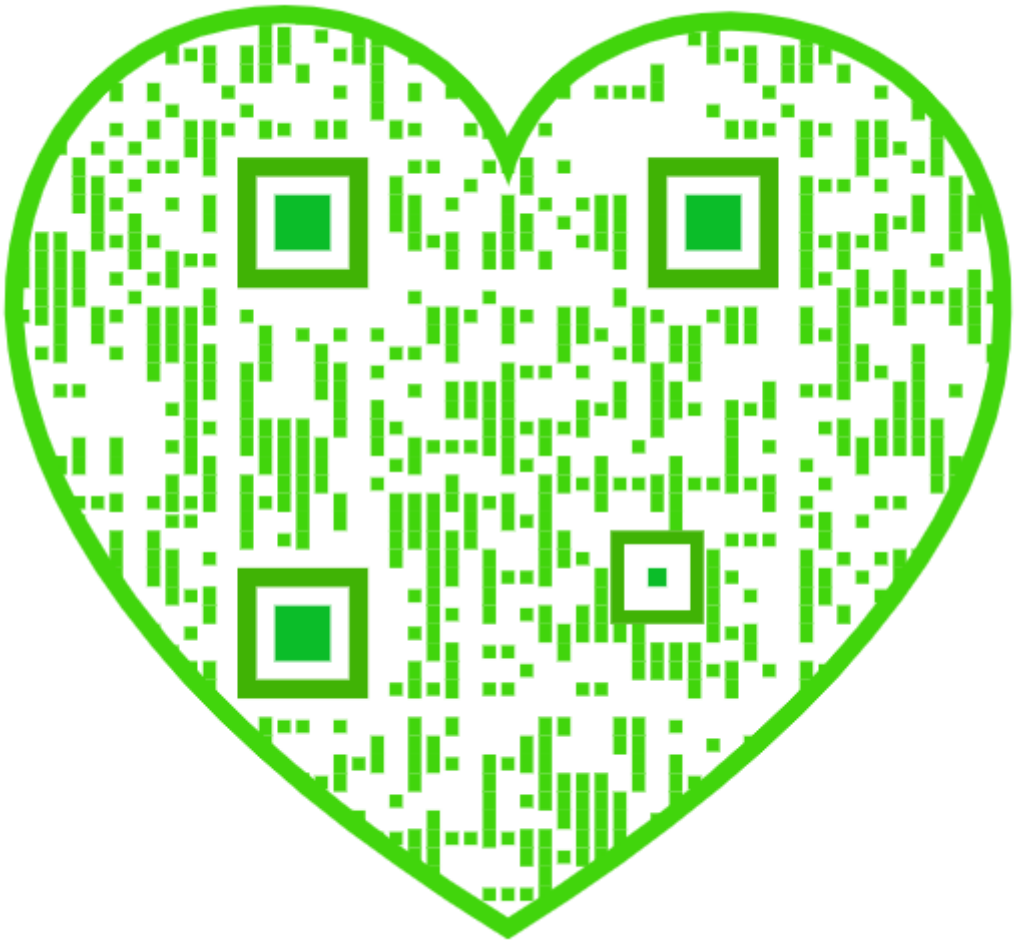

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NEW BOOK

BOTANY OF CALIFORNIA.

VOL. II.

(UNIFORM WITH THE PUBLICATIONS OF THE)
GEOLOGICAL SURVEY OF CALIFORNIA.
J. D. WHITNEY, STATE GEOLOGIST.

BOTANY.

VOLUME II.

BY SERENO WATSON.

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PREFATORY NOTE.

THE collection of materials intended to serve as the basis of a work on the Botany of California was begun under my direction, and with the authorization of the Legislature, in 1860. That the volume published in 1876 and the present one could be laid before the scientific public in a style worthy of the subject, and uniform with that of the other publications of the Geological Survey, is chiefly due to the zeal and liberality of Hon. S. C. Hastings, who solicited and obtained the necessary pecuniary means for this purpose. His fellow-contributors for the present volume were D. O. Mills, Henry Pierce, Leland Stanford, J. C. Flood, and Charles Crocker, all of San Francisco: to them I desire to return my sincere thanks in behalf of botanists throughout the world.

J. D. WHITNEY.

INTRODUCTION.

THE present volume completes the BOTANY OF CALIFORNIA so far as it can be at this time satisfactorily done. An attempt was made to add the remaining Cellular Acrogens (the Hepaticæ and Characeæ), but scarcely any material has been collected in these orders excepting that which was distributed by Mr. Henry N. Bolander nearly fifteen years ago, much of which is now scattered and not accessible. The services of the late Mr. Coe F. Austin were secured for the Hepaticæ, but the manuscript as left by him proved to be too incomplete to allow of its publication. In the present transitional and somewhat chaotic state of the orders of Thallogens it was found inadvisable, not to say impossible, to furnish generic and specific descriptions of Californian forms in anticipation of the results of the general revisions which these orders are now undergoing at the hands of competent specialists. Simple lists of such reputed genera and species as have been collected in California were prepared, of the Lichenes by the kindness of Prof. Edward Tuckerman, of the Algæ by Prof. W. G. Farlow, and of the Fungi by Dr. H. W. Harkness and Mr. J. P. Moore. It was seen, however, that these would add materially to the bulk of an already sufficiently large volume, as well as delay its publication; and inasmuch as they would be of no use to the many and could be of little good to any, they have been wholly omitted. The list of Fungi has been published in the Proceedings of the California Academy, where it is readily accessible.

Several of the more important and difficult orders and genera in this volume have been furnished by specialists of the highest authority in their several departments. Dr. George Engelmann has elaborated the Oaks, the Pines and their allies, and the Loranthaceæ. M. S. Bebb, Esq., has done the same for the Willows. William Boott, Esq., has supplied the portion upon the Carices, Dr. George Thurber the Grasses, and Prof. Daniel C. Eaton the

Ferns and other higher cryptogams. If the publication of the volume has necessarily been delayed on this account, the superior character of the work is an ample compensation. The extent of the additions that have been made to our knowledge of the flora of the State during the past four years may be seen by reference to the many pages devoted to them. These additions are due to the interest and efforts of a comparatively few individuals, to whom proper acknowledgment is given in connection with Professor Brewer's account of the botanical collectors that have visited or resided in California. There still remains ample opportunity for good botanical work at almost any locality among the mountains, hills and valleys of the State, to which it is hoped that these volumes may prove both an incentive and an aid. Having thus brought to a close a work which has been far more laborious and protracted than was ever anticipated, I here return my sincere thanks to all those who have patiently waited for it, as well as to those who have in any manner assisted in its progress.

SERENO WATSON.

HERBARIUM OF HARVARD UNIVERSITY,
CAMBRIDGE, MASS., July 1, 1880.

I. ANALYTICAL ARTIFICIAL KEY TO THE ORDERS AND ANOMALOUS GENERA IN THIS VOLUME.

Subclass I. ANGIOSPERMÆ continued.

Division III. APETALÆ: corolla (and sometimes calyx) wanting. [Including the apetalous genera of the preceding Divisions.]

A. Flowers not in aments.

1. Ovary and fruit superior, 1-celled and 1-ovuled, or carpels distinct if more than one.

Stipules sheathing the stem at the nodes.
A tree: flowers monœcious in globose heads: calyx none. Platanaceæ, 85.
Herbs: calyx usually corolla-like: akene triangular or lenticular. Polygonaceæ, 77. 6.
Stipules not sheathing the stem or none.
Shrubs or trees.
Leaves alternate: flowers perfect.
Calyx 6-parted: fruit a drupe: anthers opening by valves: odoriferous evergreen. Lauraceæ, 81.
Calyx 4-cleft: fruit a berry. Thymeleaceæ, 82.
Calyx tubular, limb deciduous: fruit a tailed akene. Cercocarpus in Rosaceæ, 32.
Leaves alternate: flowers unisexual: fruit a utricle. Chenopodiaceæ, 79.
Leaves opposite.
Flowers monœcious: capsule 1-celled by abortion. Buxaceæ, 86.
Fruit an akene: leaves small and narrow. Coleogyne in Rosaceæ, 32.
Fruit a simple samara: leaves pinnate. Fraxinus in Oleaceæ, 59.
Herbaceous, or sometimes woody at base.
Fruit a utricle: seed lenticular: embryo annular or spiral.
Flowers with scarious persistent sepals and bracts: no stipules. Amarantaceæ, 78.
Bracts herbaceous or none: no stipules. Chenopodiaceæ, 79.
Stipules scarious. Illecebraceæ, 15.
Fruit a more or less triangular akene: embryo curved.
Flowers perfect, on jointed pedicels, involucrate. Polygonaceæ, 77. 6
Akene not triangular: embryo straight.
Flowers unisexual; filaments incurved in the bud: leaves simple. Urticaceæ, 84.
Submerged: flowers axillary, naked: leaves sessile, filiformly dissected. Ceratophyllaceæ, 90.
Flowers naked in a terminal spike: akene reniform: leaves trifoliate. Achlys in Berberidaceæ, 2.
Carpels several and distinct, 1–several-ovuled: calyx usually corolla-like. Ranunculaceæ, 1.

2. As in (1), but ovary and fruit inclosed by the calyx and apparently inferior.

Shrubs, with scurfy opposite entire leaves: flowers dicœcious: fruit baccate. Elæagnaceæ, 83.
Herbs: calyx corolla-like: fruit an akene.
Leaves simple, opposite, entire, without stipules: flowers involucrate. Nyctaginaceæ, 76.
Leaves compound, alternate, stipulate. Rosaceæ, 32.

3. Ovary and fruit superior, of 2 or more carpels.

Fruit 2–4-celled, usually lobed: cells 1–2-ovuled.
Fleshy maritime dicœcious shrub: ovaries 4-celled, coherent. Batideæ, 80.
Capsule 3-celled, 3-lobed: juice milky: mostly herbaceous. Euphorbiaceæ, 87.
Fruit 4-celled, 4-lobed, compressed, indehiscent: styles 2: small, aquatic, with opposite entire leaves. Callitrichaceæ, 88.
Fruit fleshy, 3-celled, 3-lobed: shrubs with alternate simple leaves. Rhamnaceæ, 27.
Fruit a double samara: trees with opposite pinnate leaves. Sapindaceæ, 29.
Cruciferous herb: pod small, obcompressed. Lepidium in Cruciferæ, 7.

Fruit capsular, 1-celled or more, several-ovuled.
Flowers naked, crowded in an involucrate spike: pungent herb with entire leaves. PIPERACEÆ, 89.
Shrub with yellow axillary flowers: capsule 4–5-celled: leaves alternate, lobed. STERCULIACEÆ, 21.
Low herbs with opposite leaves.
Capsule 3–5-celled: succulent. FICOIDEÆ, 44.
Capsule 1-celled; placentæ central.
Style and stigma one: stamens alternate with the sepals. Glaux in PRIMULACEÆ, 57.
Styles or stigmas 3 or more: stamens opposite the sepals. CARYOPHYLLACEÆ, 14.
Herbs without green foliage. Allotropa in ERICACEÆ, 54.

4. Ovary and fruit inferior.

Fruit many-seeded.
Capsule 6-celled: flowers perfect, with 3-lobed valvate calyx: perennial herbs: leaves entire, alternate. ARISTOLOCHIACEÆ, 97.
Capsule 4-celled: stamens 4: marsh herbs with entire opposite leaves. Ludwigia in ONAGRACEÆ, 39.
Capsule 1-celled with 3 parietal placentæ: perennial herb; leaves pinnatifid. DATISCACEÆ, 42.
Capsule (half-inferior) 1-celled with 2 parietal placentæ: leaves cordate. SAXIFRAGACEÆ, 34.
Fruit baccate: dicœcious leafless parasites. RAFFLESIACEÆ, 98.
Fruit mostly 1-seeded.
Flowers perfect: fruit nut-like: perennial herbs with alternate entire leaves. SANTALACEÆ, 99.
Dicœcious parasites on trees, with opposite leaves and jointed stems: berry with glutinous pulp. LORANTHACEÆ, 100.
Aquatic herbs, with opposite or verticillate leaves. HALORAGEÆ, 38.

B. Flowers unisexual, at least the staminate in aments. Trees or shrubs, with alternate leaves.

Monœcious: male flowers in aments; female solitary or few: ovary inferior.
Leaves pinnate, without stipules: fertile flowers and fruit naked. JUGLANDACEÆ, 94.
Leaves simple, with caducous stipules.
Anthers 2-celled: nut in a cup-like or spiny involucre. CUPULIFERÆ, 95.
Anther-cells separate: nut in a foliaceous or tubular involucre. CORYLACEÆ, 96.
Monœcious or dicœcious, flowers all in aments: ovary superior.
Fruit a 1-seeded nutlet.
Bracts thickened and rigid in fruit: nut winged or angled. BETULACEÆ, 91.
Bracts scaly: fruit wax-coated or drupe-like. MYRICACEÆ, 92.
Fruit a many-seeded capsule: dicœcious: bracts herbaceous: seeds comose. SALICACEÆ, 93.

SUBCLASS II. GYMNOSPERMÆ. Ovules naked upon a scale or bract or within a more or less open perianth. Monœcious or dicœcious trees or shrubs.

Male flowers in aments: female subsolitary, the ovule within a double coriaceous integument with small terminal orifice: nearly naked dicœcious shrubs. GNETACEÆ, 101.
Flowers dicœcious, solitary, axillary: ovule becoming a bony seed within a fleshy envelope or cup. TAXACEÆ, 102.
Female flowers in aments becoming dry cones or berry-like: ovules naked at the base of a scale. CONIFERÆ, 103.

CLASS II. MONOCOTYLEDONOUS OR ENDOGENOUS PLANTS. Woody fibres of the stem scattered irregularly. Usually with the parts of the flower in threes and leaves parallel-veined. Cotyledon simple. Mostly herbaceous.

A. Ovary inferior: perianth conspicuous, colored: perennials.

Aquatic: leaves opposite or whorled, 1-nerved: flowers dicœcious, regular, axillary, solitary. HYDROCHARIDACEÆ, 104.
Terrestrial: flowers perfect.
Flowers irregular: stamens and style coherent; anthers 1 or 2: leaves alternate, sheathing. ORCHIDACEÆ, 105.
Flowers regular: stamens 3, perigynous: leaves equitant. IRIDACEÆ, 106.
Flowers regular: stamens 6, perigynous: leaves not equitant. AMARYLLIDACEÆ, 107.

B. Ovary superior or nearly so: perianth regular or none.

Carpels united into a compound ovary: perianth corolla-like rarely partly herbaceous: seed albuminous.
  Flowers not upon a spadix.
    Terrestrial; stems from a bulb, corm or rhizome: anthers 2-celled. LILIACEÆ, 108.
    Woody climber, with tendrils: anthers 1-celled. SMILACEÆ, 109.
    Submerged aquatic, with linear grass-like leaves. PONTEDERIACEÆ, 110.
  Flowers crowded upon a spadix: fruit fleshy and coalescent, 2-celled. ARACEÆ, 111.
Carpels distinct (or separable) or solitary: aquatic or marsh herbs.
  Perianth none: seeds albuminous: fruit utricular or nut-like.
    Flowers monœcious in heads or on a crowded spadix: leaves linear. TYPHACEÆ, 112.
    Small floating disk-like plants. LEMNACEÆ, 113.
  Perianth herbaceous, petaloid, or none: albumen none.
    Carpels few: perianth none or in fertile flowers herbaceous and valvate. NAIADACEÆ, 114.
    Carpels numerous in a whorl or head: 3 sepals herbaceous, 3 petaloid. ALISMACEÆ, 115.
Perianth of 6 similar glumaceous segments: capsule 3-valved. Rushes or sedge-like. JUNCACEÆ, 116.
Perianth coriaceous in two dissimilar series: fruit a berry or drupe: palms. PALMÆ, 117.
Flowers in the axils of scales or glumes, spicate, without evident perianth.
  Stems solid; sheaths closed; scales single; anthers basifixed. CYPERACEÆ, 118.
  Culms hollow, terete; sheaths split; glumes in pairs; anthers versatile. GRAMINEÆ, 119.

SERIES II. CRYPTOGAMOUS PLANTS. Flowers without stamens or pistils, and not producing seeds with an embryo.

CLASS III. ACROGENOUS PLANTS. Plants growing from the apex, and mostly with distinct leaves.

SUBCLASS I. VASCULAR ACROGENS. Plants with both woody and vascular tissue.

A. Spores only of one kind.

Cylindric jointed leafless plants with toothed sheaths: fructification in a terminal spike. EQUISETACEÆ, 120.
Fronds fern-like, erect in vernation: sporangia globose, coriaceous, in a spike or panicle. OPHIOGLOSSACEÆ, 121.
Fronds circinate in vernation: fructification on their under surface FILICES, 122.

B. Spores of two kinds.

Fructification within the base of the leaves or in their axils. SELAGINELLEÆ, 123.
Spores contained within pedunculed capsules borne by the rhizomes. MARSILIACEÆ, 124.
Floating fronds small, pinnately branched: spores at the base. SALVINIACEÆ, 125.

SUBCLASS II. CELLULAR ACROGENS. Plants with cellular tissue only.

Capsule usually opening by a lid, containing spores without spiral fibres.
  Branches not regularly fascicled: areolation simple: spores of one kind. MUSCI, 126.
  Branches regularly fascicled: areolation of colorless cells and green linear ducts: spores of 2 kinds. SPHAGNACEÆ, 127.

II. SYNOPTICAL KEY TO THE ORDERS, &c.

SUBCLASS I. ANGIOSPERMÆ continued.

DIVISION III. APETALÆ: corolla (and sometimes calyx) wanting.

A. Ovary superior, free from the calyx though sometimes enveloped in it.

* Ovary 1-celled: ovules solitary, basal: embryo coiled or more or less curved. Herbs or rarely shrubs.

\+ Fruit an akene.

76. **Nyctaginaceæ**, p. 1. Calyx corolla-like, tubular to funnelform or campanulate, the persistent base hardening and enclosing the akene. Stamens hypogynous. Style simple. Herbaceous, with opposite entire leaves, no stipules, and involucrate flowers.

77. **Polygonaceæ**, p. 6. Calyx mostly persistent, of 3 to 6 segments, distinct in 2 rows or united, the inner or all petaloid. Stamens perigynous. Styles 2 to 4. Akene mostly triangular. Embryo nearly straight. Herbs or rarely woody, with mostly alternate entire leaves, with or without sheathing stipules; flowers on jointed pedicels, often involucrate.

\+ \+ Fruit a utricle: flowers sessile: leaves mostly alternate; stipules none.

78. **Amarantaceæ**, p. 40. Calyx persistent, of 3 to 5 distinct more or less scarious sepals in one row. Stamens hypogynous. Style simple or none. Seed lenticular, vertical. Embryo annular. Herbs with entire leaves; flowers scarious-bracteate.

79. **Chenopodiaceæ**, p. 43. Calyx of 5 or fewer mostly herbaceous sepals in 1 row, or none. Styles or stigmas 1 to 4. Embryo annular or spiral. Herbs or shrubby; flowers often unisexual, the perfect and staminate without bracts, the pistillate usually naked within herbaceous bracts.

* * Ovary 4-celled: ovules solitary, basal: embryo curved.

80. **Batideæ**, p. 60. A fleshy maritime shrub, with diœcious bracteate flowers in sessile axillary ament-like spikes. Ovaries coherent, becoming fleshy.

* * * Ovary 1-celled: ovules solitary, pendulous or sometimes erect: embryo straight.

\+ Trees or shrubs, with alternate entire leaves and no stipules: fruit a berry or drupe: embryo with large thick cotyledons.

\++ Flowers perfect; calyx deciduous: ovule pendulous.

81. **Lauraceæ**, p. 60. Calyx 6-parted. Anthers opening by valves. Fruit a drupe. Aromatic trees.

82. **Thymeleaceæ**, p. 61. Calyx gamosepalous, 4-cleft. Fruit a berry. Shrubs with very tough bark.

\++ \++ Flowers diœcious: calyx persistent about the ovary, becoming thickened or baccate: ovule erect.

83. **Elæagnaceæ**, p. 62. Calyx of fertile flowers tubular. Shrubs with scurfy foliage.

\+ \+ Herbs or trees, with unisexual flowers, and mostly lobed or serrate and stipulate leaves: fruit an akene.

84. **Urticaceæ**, p. 63. Filaments inflexed in the bud. Akene flattened ovoid. Seed erect. Herbs with tough bark, mostly opposite and serrate leaves, and usually cymose axillary inflorescence.

90. **Ceratophyllaceæ**, p. 78. Submerged aquatic, with sessile filiformly divided exstipulate leaves and axillary sessile flowers without calyx. Anthers sessile. Akene beaked. Ovule pendulous.

85. **Platanaceæ**, p. 65. Inflorescence in dense globose heads. Akene obpyramidal, beaked. Ovule pendulous. Trees with flaky bark and lobed stipulate leaves.

* * * * Ovary compound, with usually 1 or 2 anatropous pendulous ovules in each cell : styles distinct : fruit with as many lobes as cells, capsular or indehiscent.

86. **Buxaceæ**, p. 66. Monœcious shrub, with opposite entire leaves, watery juice, and large 1-celled (by abortion) and 1-seeded capsule.
87. **Euphorbiaceæ**, p. 67. Flowers monœcious or diœcious (or involucrate and apparently perfect). Capsule 3-celled, 3-seeded. Herbs or rarely woody, with milky juice and mostly alternate often stipulate leaves.
88. **Callitrichaceæ**, p. 76. Small aquatics with opposite entire leaves, no stipules, and monœcious solitary axillary flowers. Stamen 1. Fruit compressed, 4-lobed, indehiscent.
89. **Piperaceæ**, p. 77. Flowers perfect in an involucrate spike. Capsule 1-celled with 3 or 4 parietal placentæ and 2 or more ascending ovules on each placenta. Herbs with alternate leaves and no stipules.

* * * * * Flowers in aments, without calyx, monœcious or diœcious : ovary 1 – 2-celled : albumen none. Trees or shrubs, with alternate mostly toothed and stipulate leaves.

91. **Betulaceæ**, p. 79. Aments axillary and terminal ; bracts thickened and rigid in fruit. Ovary 2-celled, with a pendulous anatropous ovule in each cell, becoming a winged or angled nutlet. Monœcious.
92. **Myricaceæ**, p. 81. Aments sessile, axillary, with scaly bracts. Ovary 1-celled, with an erect orthotropous ovule, becoming a drupe-like waxy nutlet. Monœcious or diœcious shrubs.
93. **Salicaceæ**, p. 82. Aments axillary or terminal, with herbaceous bracts. Ovary 1-celled, with several basal anatropous ovules. Fruit a capsule with comose seeds. Diœcious.

B. Ovary inferior.

* Monœcious trees or shrubs, male flowers in aments, the pistillate solitary or few : fruit a nut : albumen none : leaves alternate.

94. **Juglandaceæ**, p. 92. Ovary 1-celled, with an erect orthotropous ovule. Style 1. Calyx becoming fleshy, enclosing a bony nut. Leaves pinnate, without stipules.
95. **Cupuliferæ**, p. 93. Pistillate flowers sessile (1 to 5) in a cup-like involucre. Ovary 2 – 6-celled, 4 – 12-ovuled, becoming a 1-celled 1-seeded nut in a thickened scaly or spiny involucre. Styles 2 to 6. Anthers 2-celled. Leaves pinnately veined, with caducous stipules.
96. **Corylaceæ**, p. 100. Pistillate flowers in a short ament. Ovary imperfectly 2-celled, with 2 pendulous ovules. Fruit a 1-celled 1-seeded nut in a foliaceous-tubular involucre. Anther-cells separate. Leaves doubly toothed, plicate in vernation.

* * Herbaceous : flowers perfect or diœcious, with colored calyx : stamens epigynous : ovary compound, with numerous ovules : fruit a capsule or berry : seeds albuminous.

97. **Aristolochiaceæ**, p. 101. Flowers perfect ; calyx regular or irregular, 3-lobed, valvate. Stamens 6 to 12. Capsule 6-celled. Perennial herbs.
98. **Rafflesiaceæ**, p. 102. Leafless parasites, with regular mostly diœcious flowers. Fruit baccate.

* * * Herbaceous or woody : calyx valvate, greenish ; stamens opposite the sepals : ovary 1-celled, few-ovuled, becoming a 1-seeded berry or nut-like : seeds albuminous : leaves entire, without stipules.

99. **Santalaceæ**, p. 103. Flowers perfect. Ovules 2 to 4, suspended from the top of a free central placenta. Fruit nut-like, 1-seeded. Herbaceous with alternate leaves.
100. **Loranthaceæ**, p. 104. Parasitic diœcious evergreens on shrubs or trees, with opposite leaves and jointed stems. Ovule solitary, erect, orthotropous. Fruit a berry with glutinous pulp.

SUBCLASS II. GYMNOSPERMÆ. Ovules naked upon a scale, bract, or disk, or within a more or less open perianth. Monœcious or diœcious trees or shrubs, mostly evergreens, with usually rigid needle-shaped, subulate, or scale-like leaves.

101. **Gnetaceæ**, p. 108. Nearly naked jointed diœcious shrubs. Male flowers in aments ; anthers opening by terminal slits. Female subsolitary, bracteate, the ovule within an oblong-ovoid perianth, open only at the apex, becoming hardened-coriaceous in fruit.
102. **Taxaceæ**, p. 109. Diœcious evergreens. Flowers solitary, axillary. Ovule solitary, in fruit a bony seed within a fleshy envelope or cup-shaped disk.
103. **Coniferæ**, p. 111. Mostly monœcious and evergreen. Female flowers in scaly aments becoming cones or berry-like. Ovules 2 or more at the base of each scale.

CLASS II. MONOCOTYLEDONOUS OR ENDOGENOUS PLANTS. Stems without pith or annular layers, the woody fibres scattered irregularly. Parts of the flower usually in threes and leaves mostly parallel-veined. Embryo with a single cotyledon.

A. Ovary inferior: perianth conspicuous, colored: herbaceous perennials.

* Aquatic, with regular dicecious flowers in a spathe: embryo distinct, without albumen.

104. **Hydrocharidaceæ**, p. 129. Flowers axillary, solitary, with tubular perianth. Fruit indehiscent. Leaves opposite or whorled, 1-nerved.

* * Flowers perfect, irregular: seeds numerous, minute, with obscure embryo and no albumen.

105. **Orchidaceæ**, p. 130. Stamens and style coherent. Anthers 1 or 2. Capsule 1-celled, with 3 parietal placentæ. Leaves alternate.

* * * Flowers perfect, regular: embryo distinct, with albumen: capsule 3-celled.

106. **Iridaceæ**, p. 138. Stamens 3, at the base of the perianth. Flowers spathaceous. Leaves equitant.

107. **Amaryllidaceæ**, p. 141. Stamens 6, on the perianth-tube. Leaves not equitant.

B. Ovary superior or nearly so: perianth regular or none.

* Carpels united into a compound ovary: perianth colored (outer series rarely herbaceous): albumen present.

108. **Liliaceæ**, p. 143. Stems from bulbs, corms or rhizomes: anthers 2-celled: fruit a 3-celled capsule (1-celled in *Scoliopus*) or a berry.

109. **Smilaceæ**, p. 186. Woody climber with tendrils. Flowers dicecious, small, 6-parted. Anthers 1-celled. Fruit a berry.

110. **Pontederiaceæ**, p. 186. Herbaceous aquatic, with spathaceous tubular flowers. Ours with grass-like leaves, solitary axillary flowers, and 1-celled 3-valved capsule.

111. **Araceæ**, p. 187. Flowers crowded upon a spadix. Ours acaulescent, with 4-lobed perianth, 4 stamens, and 2-celled 2-ovuled ovaries fleshy and coalescent in fruit.

* * Aquatics: ovary 1-celled, utricular or nut-like in fruit: perianth none: seed albuminous.

112. **Typhaceæ**, p. 188. Flowers monœcious, in heads or crowded on a spadix. Stems solid, terete, with linear leaves, from creeping rootstocks.

113. **Lemnaceæ**, p. 189. Very small floating stemless plants, with disk-like fronds.

* * * Aquatic or marsh plants: carpels distinct or separable (sometimes single): perianth herbaceous or petaloid or none: albumen none.

114. **Naiadaceæ**, p. 190. Carpels few (1 to 6). Perianth of fertile flowers of 4 to 6 herbaceous valvate sepals or none.

115. **Alismaceæ**, p. 199. Carpels numerous, verticillate or capitate. Perianth-segments 6, distinct, 3 herbaceous, 3 petaloid.

* * * * Perianth of 6 equal persistent glumaceous segments: fruit a capsule.

116. **Juncaceæ**, p. 201. Capsule loculicidally 3-valved. Seed albuminous. Rushes or sedge-like, with perfect flowers.

* * * * * Perianth of 6 herbaceous segments in two dissimilar series. Fruit a 1-seeded drupe or berry.

117. **Palmæ**, p. 210. Flowers on a branching spadix, usually spathaceous. Carpels 3, distinct or coherent. Seeds large, albuminous. Trees, with fan-shaped or pinnate leaves.

* * * * * * Flowers in the axils of scales or glumes, without evident perianth, in spikes: stamens 1 to 3: ovary 1-celled, 1-ovuled: seed albuminous. Sedges and grasses.

118. **Cyperaceæ**, p. 212. Scales single. Perianth none or replaced by bristles. Stamens basifixed. Fruit a triangular or lenticular akene. Stem solid, often triangular, with closed sheaths.

119. **Gramineæ**, p. 253. Glumes in pairs. Perianth replaced by minute scales. Anthers versatile. Fruit a caryopsis. Culm hollow, terete; sheaths split to the base.

SERIES II. CRYPTOGAMOUS OR FLOWERLESS PLANTS. Flowers without stamens or pistils, in fruit producing spores instead of seeds.

CLASS III. ACROGENOUS PLANTS. Growing from the apex of a distinct axis, mostly with distinct leaves.

SUBCLASS I. VASCULAR ACROGENS. Plants with both woody and cellular tissue: reproductive organs of one or both sexes produced upon a prothallus developed from the spore.

DIVISION I. ISOSPOROUS VASCULAR ENDOGENS. Spores only of one kind, the prothallus bearing organs of both sexes.

120. **Equisetaceæ**, p. 329. Cylindric jointed hollow-stemmed plants, with toothed sheaths. Fructification in a terminal spike.
121. **Ophioglossaceæ**, p. 331. Fronds often fern-like, erect in vernation. Sporangia globose, coriaceous, in special spikes or panicles.
122. **Filices**, p. 332. Ferns, with fronds circinate in vernation, bearing the fructification on the under surface or beneath the margin.

DIVISION II. HETEROSPOROUS VASCULAR ACROGENS. Spores of two kinds, one producing a prothallus with archegonia, the other smaller and containing antherizoids.

123. **Selaginelleæ**, p. 349. The two kinds of spores borne separately upon the upper side of the base of linear grass-like radical leaves or in the axils of small leaves arranged in 4 ranks upon a stem.
124. **Marsiliaceæ**, p. 351. Spores of both kinds together in pedunculed capsules borne upon a rhizome. Leaves filiform or pedately quadrifoliolate. In mud.
125. **Salviniaceæ**, p. 352. Small floating plants, the spores borne in separate capsules at the base of the frond.

SUBCLASS II. CELLULAR ACROGENS. Plants with cellular tissue only: reproductive organs borne upon the stem or branches.

A. Capsules mostly opening by a lid, containing numerous spores without spiral fibres (*elaters*).

126. **Musci**, p. 353. Branches not regularly fascicled along the stem. Tissue of the leaves homogeneous. Spores of one kind.
127. **Sphagnaceæ**, p. 421. Branches regularly fascicled. Tissue formed of colorless cells and intermediate green linear ducts. Spores of two kinds. Pale flaccid bog plants.

B. Capsule not opening by a lid: spores mixed with elaters.

128. **Hepaticæ**. Stems procumbent, leafy with alternate or distichous leaves, or thalloid.

C. Sporangium consisting of a single large spore surrounded by spirally arranged tubes.

129. **Characeæ**. Submerged aquatics, with whorled branches, consisting of tubular cells placed end to end.

CLASS IV. THALLOGENS. Growth chiefly peripherical and horizontal, without definite axis, mostly without leaves, and composed wholly of cellular tissue: spores not developing a prothallus. [Added here to complete the Series.]

130. **Lichenes**. Not parasitic, on exposed surfaces, prostrate and crustaceous or frondose, or erect, containing chlorophyllose granules. Reproductive organs of two kinds, *apothecia* and *spermogonia*.
131. **Fungi**. Parasitic, wholly without chlorophyll, the organs of vegetation (*mycelium*) mostly subterranean or concealed, the reproductive very various in form and structure.
132. **Algæ**. Aquatic, mostly submerged, not parasitic, always containing chlorophyll and usually highly colored. Reproductive organs very various.

BOTANY

OF

CALIFORNIA.

Division III. APETALÆ.

Floral envelope consisting only of a calyx (often petaloid), or wholly wanting.

Order LXXVI. NYCTAGINACEÆ.

Herbs (or rarely woody) with fragile stems and tumid joints, entire petiolate exstipulate leaves mostly opposite and unequal, and perfect flowers with corolla-like tubular to campanulate perianth, the persistent base indurated and constricted over the 1-celled and 1-seeded free ovary; stamens few, hypogynous, with slender filaments and rounded anthers; style and stigma simple; seed erect, anatropous, with embryo encircling usually copious mealy albumen, the cotyledons foliaceous. — Flowers with a calyx-like 3 – 5-cleft common involucre, often enlarging in fruit, or with dilated and colored involucral bracts; perianth plicate in æstivation. Stamens often connate at base. Fruit consisting of the hardened base of the perianth, often costate, striate, or winged, enclosing the free akene; testa membranous. Embryo in *Abronia* apparently monocotyledonous by abortion.

An order of about 20 genera and 100 or more species, chiefly of temperate and tropical America, exclusively so with the exception of *Boerhaavia* and *Pisonia*, which are represented in tropical Asia and Australia. Most of the United States species (about 40) are peculiar to the drier interior region. The purgative and emetic qualities in the roots of many species are well known.

Tribe I. MIRABILEÆ. Involucre calyx-like, 3 – 5-cleft or -parted, 1 – 12-flowered. Perianth tubular to funnelform or campanulate.

1. **Mirabilis.** Involucre 5-lobed, not changed in fruit. Fruit not angled nor winged, and scarcely or not at all ribbed. Stamens usually 5.
2. **Allionia.** Involucre deeply 3-lobed, 3-flowered. Fruit with a double line of tubercles on the back, surrounded by a rigid winged margin, toothed and inflexed. Stamens usually 3.

Tribe II. ABRONIEÆ. Involucre of 5 or more distinct bracts, subtending a many-flowered head.

3. **Abronia.** Perianth salver-form, including the stamens and style. Fruit wing-angled.

Tribe III. ACLEISANTHEÆ. Involucre only of 2 or 3 small bractlets to each flower, or wholly wanting: stigma smooth, peltate or cap-shaped.

4. **Boerhaavia.** Inflorescence usually paniculate or spicate. Fruit 5-angled.

Tribe IV. BOUGAINVILLEÆ. Involucral bracts dilated, mostly solitary on the pedicel of each flower.

5. **Hermidium.** Perianth tubular-campanulate. Fruit smooth, not ribbed nor angled.

1. MIRABILIS, Linn. Four-o'clock.

Involucre calyx-like, 5-cleft or -parted, herbaceous, often large but unchanged in fruit, 1–12-flowered. Perianth tubular or more or less broadly funnelform, with a spreading limb. Stamens usually 5, as long as the perianth; filaments united at base. Stigma capitate, granulate. Fruit globose to ovate-oblong, smooth, obscurely or not at all ribbed or angled. — Perennial herbs, with opposite leaves nearly equal in the pairs: peduncles solitary in the axils or paniculate: flowers nearly sessile in the involucres.

A genus of 10 or 12 species, of the Western United States and Mexico, the earliest known species also from South America and common in cultivation (the Four-o'clock or Marvel-of-Peru, *M. Jalapa*), now naturalized in many countries. In this, as in some other genera, the flowers frequently are fertilized in the bud, in which case the perianth remains small without opening.

§ 1. *Flowers 3 or more in the involucre, large, with long-tubular or funnelform perianth.* — Quamoclidion, Choisy.

1. **M. multiflora,** Gray. Stout, spreading, roughish puberulent or nearly glabrous; stems 2 or 3 feet long: leaves rather thin, broadly ovate to ovate-lanceolate, often somewhat cordate at base but decurrent upon the petiole, acute or shortly acuminate, 1 to 3 inches long, on slender petioles half an inch long or less: peduncles ½ to 2 inches long: involucre large, about an inch long, 5-cleft a third to half the way down; the lobes acute or acuminate: flowers usually 6 (5 surrounding a central one), broadly funnelform, pale rose-color to purple, with the tube somewhat greenish, 1½ to 2 inches long: stamens 5, as long as the acutely 5-lobed perianth, shorter than the filiform style: fruit ovate-oblong, 3 or 4 lines long, rarely nearly globose, marked toward the base by 10 shallow furrows and as many intermediate dark lines. — Bot. Mex. Bound. 173. *Oxybaphus multiflorus,* Torrey, Ann. Lyc. N. York, ii. 237. *Nyctaginia (?) Torreyana,* Choisy in DC. Prodr. xiii². 430. *Quamoclidion multiflorum,* Torrey, Am. Journ. Sci. 2 ser. xv. 321.

Var. **pubescens,** Watson. Very pubescent throughout.

A common species eastward, ranging from Colorado to the Rio Grande and westward to S. California; San Diego (*Cleveland*). The variety is peculiar to S. California, from near Fort Tejon (*Wallace, Kennedy*) to San Diego County, *Palmer*. A doubtful form occurs in cultivation from Californian seed (Hook. f. Bot. Mag. t. 6266), still more glandular-pubescent, the leaves broadly ovate, deeply cordate at base and not decurrent upon the very short petiole, obtuse or acutish: lobes of the involucre acutish, and those of the perianth retuse: fruit not at all furrowed at base, sometimes very obscurely lined. It is perhaps the *Oxybaphus Fœbelii* of Behr. Proc. Calif. Acad. i. 69, from near Warner's Ranch in the mountains of San Diego County, but the description is very defective.

2. **M. Greenei,** Watson. Very stout, somewhat glandular-puberulent: leaves rather thick, ovate, acute, attenuate to a short stout petiole, 3 inches long: involucre acutely lobed, 1 to 1½ inches long, 7–10-flowered: perianth funnelform, a half longer than the involucre: fruit ovate-oblong, 3 to nearly 4 lines long, usually abruptly contracted near the base, rather strongly 5-angled, the sides somewhat ridged longitudinally and more or less irregularly tuberculate. — Proc. Am. Acad. xii. 253.

Collected by *Rev. E. L. Greene* on mountain-sides about Yreka, Siskiyou County; June, in flower and fruiting.

§ 2. *Flowers 1 to 3 in the involucre, rather small; the perianth broad funnelform from a short tube.* — OXYBAPHOIDES, Gray.

3. **M. Californica,** Gray. Stems ascending from a somewhat woody base, a foot or two long, the whole plant yellowish-green, more or less viscid-pubescent: leaves thickish, rounded ovate to cordate and ovate-oblong, 6 to 15 lines long, obtuse or acute, on very short petioles: involucres on short peduncles or nearly sessile, small (2 to 3 lines long), 5-cleft, the lobes equal or slightly unequal, acute: perianth rose-color or purple, narrowly campanulate, 5 lines long, the lobes spreading, emarginate: stamens as long, nearly equalling the style: fruit ovate, smooth, 1½ lines long. — Bot. Mex. Bound. 173; Torrey, same, 169, t. 48. *Oxybaphus glabrifolius,* var. *crassifolius,* Choisy, l. c. 431.

On dry hillsides, Southern California and eastward, from Los Angeles and Northern Nevada to Lower California and Southern Utah. This is probably the *Oxybaphus lævis,* Benth., from Magdalena Bay, though described as glabrous throughout and with very unequal involucral lobes.

2. ALLIONIA, Linn.

Involucre calyx-like, 3-parted, herbaceous, scarcely changed in fruit, 3-flowered. Perianth funnelform, with an oblique 4 – 5-lobed limb. Stamens 3 to 5, included, nearly distinct. Stigma capitate. Fruit ovate, compressed, smooth and convex on the inner side, the back with a rigid inflexed toothed margin enclosing a double line of stipitate tubercles. Embryo plicate, the inner cotyledon shorter. — Annual or perennial herbs, with opposite very unequal leaves, and axillary pedunculate flowers.

Probably only a single very variable species, common to North and South America.

1. **A. incarnata,** Linn. Annual, or the root sometimes biennial or perhaps perennial, the slender branching stems prostrate, a foot or two long or more; pubescence viscid, short or floccose: leaves ovate, ½ to 1½ inches long, very unequal, obtuse or acute, the oblique base acutish or rounded or cordate, exceeding the slender petiole: peduncles usually shorter than the leaves: involucres cleft nearly to the base; lobes concave, broadly oblong or rounded, 1½ to 2½ lines long: perianth rose-colored or white, 2 to 4 lines long; lobes emarginate, one of them much shorter than the rest: fruit a line and a half long, usually somewhat carinate on the convex side, the margin varying greatly in the number and shape of the teeth, which are usually 5 (1 to 7) on each side, very broad or slender, sometimes gland-tipped. — Choisy, DC. Prodr. xiii². 434. *A. malachroides,* Benth. Bot. Sulph. 44.

In Southern California, from Monterey (*Edwards*) to Fort Yuma (*Thomas*), and more frequent eastward to Texas and southward; found also in Cuba, and in South America from Venezuela to Chili.

3. ABRONIA, Jussieu.

Involucre of 5 to 15 distinct somewhat scarious leaflets, enclosing numerous sessile flowers. Perianth salverform, the tube elongated, and the limb of 5 (or 4) obcordate or emarginate segments. Stamens usually 5, unequal, included in the tube and adnate to it. Style included: stigma linear-clavate. Fruit coriaceous or indurated, 3 – 5-winged, mostly reticulately veined, enclosing a smooth cylindrical akene. Embryo by abortion monocotyledonous. — Annual or perennial herbs, often prostrate, and usually more or less viscid-pubescent, with thick opposite unequal leaves, and elongated axillary and terminal peduncles: flowers usually very fragrant and showy.

A genus peculiar to Western North America. The wings of the fruit are often very unequally developed.

§ 1. *Wings coriaceous, lateral and not completely encircling the fruit.* — ABRONIA proper.

* *Body of the fruit more or less rigid or ligneous, the wing consisting of a simple lamina.*

1. **A. umbellata,** Lam. Perennial, prostrate, slender, viscidly puberulent, the stems often elongated, 1 to 3 feet long: leaves nearly glabrous, ovate to narrowly oblong, 1 to 1½ inches long, attenuate into a slender petiole, obtuse, the margin often somewhat sinuate: peduncles 2 to 6 inches long: involucral bracts small, narrowly lanceolate, 2 or 3 lines long, 10–15-flowered: perianth rose-colored, 6 to 8 lines long, with emarginate lobes: fruit 4 or 5 lines long, nearly glabrous, the body oblong, attenuate at each end; the thin wings nearly as long, rounded, broadest above and often truncate, narrowing downward to the base of the fruit: akene 1½ lines long. — Ill. i. 469, t. 105; Hook. Exot. Fl. iii. t. 194; Watson, Bot. King Exp. 476, t. 31, fig. 7.

Common on the sands of the sea-coast, from the Columbia River to Lower California. Flowers with little fragrance.

2. **A. maritima,** Nutt. in herb. Very stout, prostrate, somewhat pubescent and viscid: leaves thick, broadly ovate to oblong, cuneate or rounded at base, about an inch long, on short stout petioles: peduncles usually a little exceeding the leaves: involucral bracts short, ovate oblong: flowers "bright red," half an inch long: fruit viscid-pubescent, the wings somewhat coriaceous, otherwise nearly as in the last.

On the sea-coast from Santa Barbara to San Diego; resembling *A. latifolia* in habit.

3. **A. villosa,** Watson. A smaller and more slender plant than *A. umbellata,* apparently annual, covered with a more or less dense spreading glandular villous pubescence: leaves usually small, rarely an inch long: peduncles 1 to 3 inches long, 5–15-flowered: involucral bracts lanceolate, acuminate, 3 or 4 lines long: perianth rose-colored or purplish, the lobes obcordate with a deep sinus: fruit 3 lines long, strongly reticulate-veined, the broad wings usually truncate and acute or rounded above. — Amer. Naturalist, vii. 302.

Colorado Valley (*Palmer*), and eastward to Southern Utah, *Wheeler, Jaurier, Parry.*

A. GRACILIS, Benth. Bot. Sulphur, 44, from the coast of Lower California, may perhaps be distinguished from very slender forms of *A. umbellata* by the more strongly sinuate leaves, and by the body of the smaller fruit not attenuate above the wings.

A. MELLIFERA, Dougl. (Hook. Bot. Mag. t. 2879), the only other species of the group, is found in Washington Territory and Oregon, at a distance from the coast, and may be known from *A. umbellata* by its stouter habit, much larger scarious involucre, and larger white flowers; the fruit 4 or 5 lines long, with narrower wings, often laterally elongated.

* * *Fruit wholly coriaceous and the central cavity extending through the wings.*

4. **A. latifolia,** Eschscholtz. Perennial, stout and fleshy, very viscid-pubescent, the stems a foot or two long, prostrate: leaves thick, broadly ovate or reniform, ½ to 1½ inches long, obtuse, on short thick petioles: peduncles usually exceeding the leaves: involucral bracts 5, rounded to ovate or oblong, 2 to 4 lines long: flowers numerous, 5 or 6 lines long, bright yellow, the lobes emarginate: fruit 4 to 6 lines long, coriaceous, acute at each end, the wings more or less developed, usually narrow. — Mém. Acad. Petersb. x. 281. *A. arenaria,* Menzies; Hook. Exot. Fl. t. 193; Watson, Bot. King Exp. 476.

Common on the seashore from Vancouver Island to Monterey, and perhaps still further to the south. The root is stout and fusiform, often several feet long, said to be sometimes eaten by the Indians. The flowers are very fragrant, with the odor of orange-blossoms; in spring and early summer.

5. **A. turbinata,** Torrey. Annual and slender, viscidly pubescent or only puberulent, the stems ascending or procumbent, ½ to 1½ feet long: leaves ovate to oblong-lanceolate, ½ to 1½ inches long, usually truncate-cordate or rounded at base: peduncles slender, exceeding the leaves: involucral bracts usually 5, linear or lanceolate, acuminate, somewhat scarious: perianth rose-colored, 6 to 8 lines long, the tube very narrow and lobes deeply cleft: fruit thin-coriaceous, 3 or 4 lines long, either regularly 5-winged and the wings terminating above in transverse circular disks, or unequally winged and without disks: akene a line long. — Watson, Bot. King Exp. 285, t. 31.

From the eastern border of the State and Northern Nevada to Arizona and Western Texas; near the Mohave River, *Cooper.* In dry valleys; May to August.

A. FRAGRANS, Nutt., is a very similar species ranging from the Columbia River (*Nuttall*) to Utah and New Mexico, and eastward, not found in California. It is perennial, distinguished chiefly by its more erect and stouter habit, rather larger whitish flowers, and especially by the broad scarious acute or acutish involucral lobes: the fruit is usually larger, the wings never crested.

§ 2. *Wings (usually 2 or 3) orbicular, wholly encircling the fruit, membranous, strongly net-veined. Annuals.* — TRIPTEROCALYX, Gray.

6. **A. Crux-Maltæ,** Kellogg. A low spring annual, with procumbent stems, viscid-pubescent or nearly glabrous: leaves ovate-oblong, an inch long or more, usually cuneate at base, on slender petioles: peduncles shorter than the leaves, many-flowered: involucre of 5 or more lanceolate acuminate lobes 3 or 4 lines long: flowers rose-colored, 7 to 9 lines long, with very slender greenish tube and 4 large deeply cleft lobes: stamens 3 or 4: fruit pubescent, 5 or 6 lines long, coarsely reticulate-pitted, the ovate body long-stipitate; akene 2½ lines long. — Proc. Calif. Acad. ii. 71, fig. 16; Watson, Proc. Am. Acad. xii. 253. *A. cycloptera,* Watson, Bot. King Exp. 285, in part.

A very showy and pretty spring flower of the valleys of Northwestern Nevada. Two other species belonging to this section are found on the eastern plains from the Saskatchewan to New Mexico, but do not occur west of the Rocky Mountains.

4. BOERHAAVIA, Linn.

Involucre of 1 to 3 very small bractlets to each flower, often caducous. Perianth funnelform or campanulate, 5-lobed. Stamens 1 to 3. Stigma peltate. Fruit clavate or obovate, jointed upon the pedicel, 5-costate, truncate at the apex or rounded or acute. — Slender annual or perennial herbs, diffuse or procumbent, with opposite more or less unequal leaves, and usually very small flowers in loose panicles, verticels or spikes.

A genus of 20 or 30 species, distributed through the warmer regions of the globe, many of them very illy defined and of uncertain determination. Several species occur in Arizona and eastward, but none have been collected in California. The following are given as approaching the southern borders of the State.

* *Flowers fascicled.*

B. HIRSUTA, Willd. Perennial, hirsute and glandular-pubescent, the branching stems 2 or 3 feet long or more: leaves ovate, an inch or two long, acutish, rounded at base, with an undulate sinuate margin, on short petioles: panicle loose and divaricate; flowers nearly sessile in small clusters terminating slender peduncles: bractlets minute: perianth (red) and ovary a line long: fruit 1 or 2 lines long, clavate, obtuse, 5-costate, glandular-viscid. — Choisy, DC. Prodr. xiii[2]. 451. — Specimens from the Big Cañon of the Tantillas Mountains, Lower California (*Palmer*), are probably to be referred to this species, which is credited to the western coast of Mexico and to South America. The leaves, however, are small and rounded or reniform, mucronately apiculate, the petioles but a line or two long, and the fruit acute at each end.

B. ERECTA, Linn. Annual, often rather stout, scabrous-puberulent or nearly glabrous: leaves broadly ovate to oblong, usually acute, an inch or two long, more or less exceeding the slender

petioles, minutely black-dotted, lighter colored beneath : panicle very open : bracts minute and flowers very small : fascicles usually 3-5-flowered : fruit sessile or shortly pedicellate, nearly 2 lines long, glabrous, clavate, truncate at top, 5-costate and rugulose between the ribs. — Choisy, l. c. 450. — Across the continent from the Pacific to Florida and the West Indies. A form is common in Lower California, Arizona and New Mexico, usually slender and very scabrous below, mostly with narrow leaves on very short petioles.

* * *Flowers spicate.*

B. SPICATA, Choisy, l. c. 456. A low annual, resembling *B. erecta*, but the flowers mostly solitary and scattered along the slender branches : fruit very shortly pedicellate, glabrous, rounded at the apex. — Lower California to Arizona and New Mexico.

* * * *Flowers umbellate.*

B. SCANDENS, Linn. Perennial, glabrous : leaves cordate or ovate, acute or acuminate, 1 or 2 inches long, on rather short petioles : umbels 6 – 10-flowered on simple axillary peduncles, or the inflorescence somewhat paniculate : bractlets a line or two long : pedicels slender, 2 to 6 lines long ; flowers greenish, 2 to 4 lines long including the base : stamens exserted : fruit glabrous, linear-clavate, terete and obscurely 10-costate, black-glandular toward the apex. — Choisy, l. c. 454. *B. Grahami*, Gray, Am. Journ. Sci. 2 ser. xv. 323. — From Peru to the W. Indies, New Mexico and Southern Arizona.

5. HERMIDIUM, Watson.

Characters as in *Mirabilis*, but the involucre of distinct broad foliaceous bracts, each adnate to the pedicel of a single flower. Perianth campanulate-funnelform. Stamens 5 to 7. — Flowers in capitate terminal and axillary racemes. A single species.

1. **H. alipes**, Watson. Perennial, stout and fleshy, glabrous and glaucous, the stems branched and ascending, a foot high : leaves broadly ovate to lanceolate, acute or obtuse, somewhat cordate at base, 1 to 2½ inches long, on very short thick petioles : heads about 6-flowered, on short peduncles : bracts cordate-ovate, somewhat membranaceous and more or less colored, 6 to 10 lines long, acute : perianth about equalling the bract, slightly 5-lobed, light purple : stamens and style not exserted : fruit globular, smooth. — Bot. King Exp. 286, t. 32.

On low foothills in Northwestern Nevada, near the Humboldt and Truckee Rivers, *Watson, Lemmon.* Flowering in May.

ORDER LXXVII. POLYGONACEÆ.

Herbaceous or woody plants, with tumid joints, alternate and entire leaves (except in *Pterostegia*), or sometimes verticillate and often only radical, with sheathing stipules or none ; flowers mostly perfect, on jointed pedicels ; calyx more or less petaloid, usually persistent about the free 1-celled 1-ovuled ovary ; stamens mostly 4 to 9, perigynous, with oval or oblong anthers ; styles 2 to 4, distinct or somewhat connate, opposite the angles of the ovary ; seed erect, orthotropous, with the embryo curved and at one side of the usually mealy albumen, or straight and within it. — Flowers rather small, the perianth of 3 to 6 distinct or more or less united segments, the inner ones or all usually petaloid ; fruit an akene, compressed or 3 – 4-angled or -winged.

An order of 30 genera and 700 species, mostly belonging to northern temperate regions, the large tribe of *Eriogoneæ* restricted almost exclusively to Western America. This tribe, largely represented in our flora, is wholly valueless except as a few species may become cultivated for ornament. The larger group of *Polygoneæ* furnishes the officinal Rhubarb, as well as the garden vegetable of the same name (species of *Rheum*), and the Buckwheat (*Fagopyrum esculentum*). Many species abound in oxalic acid, some have been used in dyeing, and the roots are frequently medicinal.

TRIBE I. POLYGONEÆ. Flowers without involucre. Perianth 3–6-parted. Stamens mostly 4–8. Styles 2 or 3. Herbs with alternate leaves and scarious sheathing stipules; juice usually acid, acrid or pungent.

1. **Oxyria.** Sepals 4, the outer smaller and spreading. Stigmas 2, tufted. Akene orbicular-winged. Leaves reniform.
2. **Rumex.** Sepals 6, the outer spreading, the inner enlarging and appressed to the triangular akene. Stigmas 3, tufted.
3. **Polygonum.** Sepals 4 to 6, equal, appressed to the triangular or lenticular akene. Styles 2 or 3; stigmas capitate.

TRIBE II. ERIOGONEÆ. Flowers involucrate (except in *Lastarriæa*). Perianth 3–6-parted, -cleft or -toothed. Stamens 3 to 9. Styles 3, with capitate stigmas. Herbs or woody at base, with alternate or verticillate leaves (opposite and sometimes toothed in *Pterostegia*), without stipules; juice nearly tasteless.

* Involucre unchanged in fruit or wanting: leaves entire.

\+ Flowers capitate, subtended by distinct herbaceous bracts.

4. **Nemacaulis.** Stamens 3. Akene ovoid. Annual, prostrate, with radical leaves.

\+ + Involucre tubular or campanulate: perianth corolla-like, 6-cleft or -parted.

5. **Eriogonum.** Involucre several-flowered, with 4 to 8 pointless teeth. Flowers exserted. Stamens 9. Akene mostly 3-angled. Annuals or perennials.
6. **Oxytheca.** Involucre few-flowered, herbaceous, with 3 to 5 straight acute or usually awned lobes. Flowers on exserted pedicels, pubescent. Stamens 9. Akene lenticular. Bracts ternate. Annuals.
7. **Chorizanthe.** Involucre 1- (rarely 2–3-) flowered, coriaceous or chartaceous, 3–6-angled, with 3 to 6 cuspidate often hooked teeth and sometimes as many cuspidate divaricate spurs at base. Flowers usually included. Stamens 3, 6 or 9. Akene 3-angled. Annuals.

\+ + + Involucre none: flowers somewhat axillary. Low annuals.

8. **Lastarriæa.** Perianth tubular, subcoriaceous, cuspidately 6-toothed. Stamens 3.
9. **Hollisteria.** Perianth campanulate, 6-cleft, white-woolly. Stamens 9. See page 481.

* * Involucre bract-like, enlarged in fruit, 2-lobed, 1-flowered, 2-saccate on the back.

10. **Pterostegia.** Flower sessile, included. Leaves opposite, toothed or lobed. Slender annual.

1. OXYRIA, Hill. MOUNTAIN SORREL.

Flowers perfect. Perianth herbaceous, of 4 distinct sepals; the 2 inner erect, appressed and unchanged in fruit, the outer smaller and spreading. Stamens 6. Stigmas 2, sessile, tufted. Akene compressed and thin, broadly 2-winged. Seed flat. Embryo axile in the mealy albumen, slender. — Perennial alpine and arctic herbs, erect, with long-petioled round-reniform mostly radical leaves, and small obliquely truncate scarious sheaths; flowers small and greenish, in narrowly panicled racemes. — Meisner, DC. Prodr. xiv. 37.

Only one species is known, in the mountains of Central Asia, besides the following.

1. **O. digyna,** Campdera. Rather stout and fleshy, 3 to 18 inches high, glabrous: leaves an inch or two broad: flowers in scarious-bracted fascicles, on short capillary pedicels: sepals often reddish, spatulate, thin, the outer half as long as the inner ones, narrower and carinate: akene exceeding the sepals, 1½ lines in diameter, entire or emarginate at each end. — *O. reniformis,* Hook.

At high altitudes in the Sierra Nevada, in cold wet places among rocks, and in like localities throughout the northern hemisphere, northward to the Arctic Ocean.

2. RUMEX, Linn. DOCK. SORREL.

Flowers perfect or polygamous or dioecious. Perianth of 6 sepals, distinct or nearly so, the outer 3 herbaceous, spreading or reflexed, the inner larger and some-

what colored, usually becoming enlarged and reticulated (*valves*) in fruit, appressed to the shorter 3-angled akene. Stamens 6; filaments very short. Styles 3; stigmas tufted. Embryo lateral, slender, slightly curved. — Coarse perennial herbs (sometimes shrubs or trees in the tropics), rarely biennial or annual, with more or less acid juice; stems leafy, with scarious obliquely truncate cylindrical naked sheaths; flowers small, fascicled or verticillate in paniculate racemes.

A genus of 125 species, widely distributed around the globe, several naturalized everywhere as troublesome weeds, a few rarely cultivated as pot-herbs. The roots of our species are mostly thick and fusiform, with astringent and alterative qualities. The specific characters are largely drawn from the fruit.

§ 1. *Flowers perfect or polygamous; valves enlarged, often bearing a grain-like callosity on the back: leaves never hastate, pinnately many-veined, rarely very acid.* — LAPATHUM, Meisner; the DOCKS.

* *Valves wholly without grains, mostly very large (3 lines long or more), entire or denticulate: pedicels long, jointed near the base: glabrous perennials.*

1. **R. venosus,** Pursh. Stems erect, a foot high or less, from running root-stocks, stout and leafy, with conspicuous dilated stipules: leaves on short but rather slender petioles, ovate or oblong to lanceolate, 3 to 6 inches long, acute or acuminate, only the lowest obtuse or somewhat cordate at base, the margin rarely undulate: panicle nearly sessile, short, dense in fruit: fruiting pedicels 4 to 9 lines long: valves entire, cordate-orbicular with a deep sinus, 9 to 12 lines in diameter, acutish or emarginate, bright rose-color: akene 3 lines long. — Hook. Fl. Bor.-Am. ii. 130, t. 174.

From British Columbia to the Saskatchewan and southward to Nevada and Colorado; near Carson City, Nevada, *Anderson.* In dry sandy valleys.

2. **R. hymenosepalus,** Torrey. Similar but taller and still stouter: leaves attenuate to a short very thick and fleshy petiole, narrowly oblong or lanceolate, a foot long or less, acute, undulate: pedicels 3 to 6 lines long: fruit smaller, 4 to 6 lines in diameter: akene 2 lines long. — Bot. Mex. Bound. 177.

In dry sandy places, near Nipoma (*Brewer*) and Suez River (*Bolander & Kellogg*), and also eastward in S. Utah and New Mexico. The height of the stem and the character of the root have not been noted. Dr. Parry states that the young shoots are used in Utah as a substitute for the garden rhubarb.

3. **R. occidentalis,** Watson. Tall and rather slender, often 3 to 6 feet high: leaves oblong-lanceolate, the lowest sometimes ovate, usually narrowing gradually upward from the truncate somewhat cordate base, not decurrent on the slender often elongated petiole, acute, often a foot long or more, scarcely undulate: panicle narrow, elongated, nearly leafless: pedicels filiform, 3 to 6 lines long, obscurely jointed near the base: valves broadly cordate, with a very shallow sinus, becoming about 3 lines in diameter, often denticulate near the base: akene 1½ lines long. — Proc. Am. Acad. xii. 253. *R. longifolius,* of authors, not of DC.

From Alaska to the Sacramento, and eastward to New Mexico, Colorado, the Saskatchewan and Labrador; in wet places and along streams. It has been rarely collected in California, being reported only from McCumber's in Shasta County, but is probably frequent in the northern part of the State. Much resembling *R. longifolius* of the Old World.

* * *Valves smaller, one or more of them grain-bearing.*

+ *Valves entire or only denticulate: glabrous perennials.*

4. **R. salicifolius,** Weinmann. Slender, often low, 1 to 5 feet high, usually branching and decumbent at base: leaves narrowly or linear-lanceolate, or the lowest oblong, 3 to 6 inches long or more, acuminate, attenuate into a short petiole,

not undulate, glaucous: panicle usually open, somewhat leafy, the flowers crowded upon the branches: pedicels slender, 1 to 3 lines long: valves ovate-rhomboidal to broadly deltoid, 1½ to 2 lines long, entire or denticulate, usually with very large callosities: akene a line long. — Meisner, DC. Prodr. xiv. 47.

In the valleys through the State and along the coast, ranging northward to Alaska and eastward across the continent. Readily distinguished by the narrow leaves attenuate at base. Californian specimens have more frequently the valves denticulate, forming the var. *denticulatus* of Torrey, Bot. Mex. Bound. 178. The grains vary much in their development.

5. **R. Berlandieri,** Meisner. Stems stout, from a fusiform root, 2 to 4 feet high: leaves narrowly lanceolate, very undulate, usually acuminate, narrowed below to an abruptly attenuate or somewhat truncate base, about 6 inches long or more, on very short petioles: panicle rather open with numerous dense verticils of flowers: pedicels a line or two long, jointed below the middle: valves ovate-lanceolate, 1½ lines long, entire: akene a line long. — DC. Prodr. xiv. 45.

In the valley of the Colorado (*Palmer*), and eastward to New Mexico and Texas. Specimens of Kellogg & Harford's collection (n. 867), from Fort Point, seem to belong to this species.

6. **R. crispus,** Linn. A similar species, but the leaves are more decidedly truncate at base and on rather longer petioles: verticils less dense, the slender pedicels being 2 to 4 lines long, jointed near the base: valves ovate or cordate.

It has been collected at Oakland, Monterey, and elsewhere, and will doubtless become common through much of the State. From Europe, now naturalized in many parts of the world.

7. **R. conglomeratus,** Murray. With broader ovate to lanceolate leaves, the lower cordate at base, slightly undulate: panicle open and leafy, with slender branches: pedicels very short, stout and geniculate in fruit, jointed near the base: valves small, all grain-bearing, ovate-lanceolate, acute.

Likewise introduced, originally from Europe, and collected at various localities through the entire length of the State.

+ + *Valves with slender awned teeth, grain-bearing: somewhat pubescent or scabrous.*

8. **R. maritimus,** Linn. Annual or sometimes biennial, minutely pubescent, simple or diffusely branched, the low stems erect or procumbent: leaves linear-lanceolate, usually truncate or cordate at base, 1 to 4 inches long, mostly on short petioles, somewhat wavy-margined: flowers in numerous dense verticils along the slender branches, on very short slender pedicels: valves a line long, ovate-lanceolate, all grain-bearing and with 2 or 3 long-awned teeth on each side. — Meisner, DC. Prodr. xiv. 59. *R. persicarioides,* Hook. Fl. Bor.-Am. ii. 130.

Not reported from west of the Sierra Nevada, but common eastward in the valleys in moist places, ranging north to Washington Territory and east to New Mexico, the Saskatchewan, and on the Atlantic coast; also in Europe and Northern Asia.

9. **R. obtusifolius,** Linn. Perennial, more or less scabrous: stems erect, tall and rather slender: leaves ovate-oblong to oblong-lanceolate, acute or the lower obtuse, cordate or truncate at base, 6 inches to a foot long or more, on slender petioles: flowers in numerous loose whorls, on long pedicels jointed below the middle: valves ovate-deltoid, 2 or 3 lines long, with 1 to 3 setaceous teeth on each side, usually a single valve grain-bearing.

A European and Asiatic species, sparingly introduced; Alameda County, *Kellogg.*

10. **R. pulcher,** Linn. Perennial, erect, with divaricate leafy branches becoming rigid: leaves scabrous beneath, oblong to lanceolate, acute or acuminate, the lower cordate or obtuse at base: flowers in numerous verticils, on short stout and rigid pedicels: valves ovate, 2 or 3 lines long, with 4 to 6 rigidly awned teeth on each side.

A species of the Mediterranean region, sparingly introduced.

§ 2. *Flowers diœcious or polygamous, small: valves not grain-bearing: leaves often hastate, sparingly veined. Glabrous perennials.* — §§ ACETOSA and ACETOSELLA, Meisner.

* *Valves enlarged in fruit: pedicels filiform, jointed at base: roots thickened: leaves not hastate nor very acid.*

11. **R. paucifolius,** Nutt. Stems erect and slender, a foot or two high or more, sparingly leafy: leaves narrowly to linear-lanceolate, or the lowest broader, 2 to 4 inches long, acute or acutish, attenuate to a slender petiole: branches of the naked panicle slender, erect: flowers reddish, in loose fascicles, half a line long or less, fruiting sparingly: valves cordate-ovate, entire, nearly 2 lines long, twice longer than the akene. — Watson, Bot. King Exp. 314. *R. Engelmanni*, var. (?) *Geyeri*, Meisner, DC. Prodr. xiv. 64.

In the Sierra Nevada (near Lake Tenayo, *Brewer*) and northward to Washington Territory, ranging east to Montana and Utah.

* * *Valves not enlarged nor exceeding the small akene: pedicels very short, jointed at the top: roots slender, running: leaves usually hastate, very acid.*

12. **R. Acetosella,** Linn. Very slender, 6 to 18 inches high: leaves oblong- to linear-lanceolate or oblanceolate, an inch or two long, usually hastate, the narrow lobes often toothed at base; petioles slender: panicle narrow, naked, becoming reddish: flowers very small, in loose fascicles: fruit triangular-ovate, two thirds of a line long or less, exceeding the pedicels.

A very widely spread weed from Europe, the common "sorrel" of fields and gardens, spreading rapidly in light soils by its slender running rootstocks.

3. POLYGONUM, Linn. KNOTWEED.

Flowers perfect. Perianth of 5 or 6 (rarely 4) nearly distinct often petal-like sepals, nearly equal and mostly not enlarging in fruit, erect and appressed upon the 3-angled or lenticular akene. Stamens 4 to 9. Styles 2 or 3, distinct or connate, often very short: stigmas capitate. Embryo lateral, curved, half immersed at one angle of the usually horny albumen; cotyledons usually narrow. — Annual or perennial leafy herbs, rarely woody at base; sheaths naked, ciliate, or foliaceous-margined; flowers small, in axillary, spicate, or racemose fascicles.

A genus of 200 species, distributed over the globe, of little or no value, a few very widely naturalized as weeds. The juice of some species is very pungent or acrid, never acid; roots often astringent.

§ 1. *Flowers in axillary fascicles or spicate with foliaceous bracts: leaves and bracts jointed upon a very short petiole adnate to the naked 2-lobed or lacerate sheath, obscurely pinnate-veined or veinless: perianth 5–6-parted, usually more or less herbaceous: stamens 3 to 8, the 3 inner filaments broad at base: styles 3: akene triangular.* — AVICULARIA, Meisn.

* *Smooth perennials with chestnut-brown stems woody at base, the slender branches leafy to the top: leaves thick; sheaths conspicuous: sepals colored, somewhat spreading even in fruit.*

1. **P. Paronychia,** Cham. & Schlecht. Prostrate, branching, 1 to 3 feet long; branches leafy or covered with old sheaths: sheaths large (½ inch long or more), brown and 5-nerved at base, finely lacerate above, persistent: leaves linear-lanceolate, a half to an inch long, acute, the margin revolute: flowers densely crowded at the ends of the branches in short more or less leafy spikes, rose-colored veined with green or brown, 3 lines long, on very short pedicels; sepals oblong-obovate:

stamens 8: styles as long as the ovary: akene smooth and shining, 2 lines long or more. — Linnæa, iii. 51; Meisner, DC. Prodr. xiv. 89.

On the sea-coast in sandy soil, from San Francisco to Puget Sound, often in large tufts. Spring and summer.

2. **P. Shastense,** Brewer. Prostrate or ascending, branching, the woody branches half a foot long or less, nearly naked below: sheaths with an herbaceous base, a line long and equalling the joint, the 2-lobed and scarious summit scarcely lacerate and usually deciduous by a regular transverse division: leaves oblanceolate, 4 to 6 lines long, acute, often folded, margin not revolute: flowers 1 to 3 in each of the lower axils of the leafy branches, rose-colored with a darker midvein, or nearly white, 1½ to 2½ lines long, attenuate to a slightly exserted naked pedicel; sepals round-obovate: stamens 8: styles much shorter than the ovary, persistent: akene smooth and shining, 2½ lines long. — Gray, Proc. Am. Acad. viii. 400; Watson, Am. Naturalist, vii. 664.

In the Sierra Nevada, at 8,000 to 10,000 feet altitude, from Silver Mountain to Mt. Shasta, *Brewer, Torrey, Lemmon.* August and September.

3. **P. Bolanderi,** Brewer. Stems numerous, erect from a woody base, 6 to 15 inches high, slender, simple with short very leafy erect branchlets towards the top: sheaths with an herbaceous base (a line long or less, many times shorter than the node), scarious and finely lacerate above, persistent: leaves narrowly linear to subulate, acute or cuspidate, 2 or 3 lines long, not revolute: flowers solitary in the axils on the branchlets, involucrate with a sheath-like scarious bract on the joint of the short pedicel, light rose-color, 1½ lines long; sepals oblong-ovate, slightly spreading: stamens 8 or 9: styles half as long as the ovary. — Gray, l. c.; Watson, l. c.

On dry rocky hillsides east of Napa Valley (*Brewer, Bolander*) and in the "Valley of the Sacramento," *Pickering.* Remarkable for the floral sheaths.

* * *Annuals, with striate stems: flowers in the axils of leaves or in loose virgate spikes; sepals herbaceous or colored only on the margin, close-appressed to the akene.*

+ *Branches leafy to the summit: sheaths short and mostly scarious, at length lacerate.*

4. **P. erectum,** Linn. Rather stout, erect or ascending, branching from the base, a foot or two high or more, glabrous, usually tinged with yellow, the branches very leafy throughout: leaves oblong or oval, ½ to 2½ inches long, obtuse or acutish: flowers mostly 1½ lines long, usually somewhat drooping upon the more or less exserted pedicel, often yellowish: sepals and stamens 5, rarely 6: akene very broadly ovate to lanceolate, 1 or 2 lines long, dull and granular to nearly smooth and shining. — Watson, l. c.

A very common eastern species, collected in Nevada (*Watson*) and Oregon, and doubtless to be found in California, at least as an introduced weed.

5. **P. aviculare,** Linn. A similar species, mostly prostrate with slender elongated branches, bluish-green: leaves narrower, oblong to lanceolate, acute or acutish: flowers smaller, usually less than a line long, tinged with white or rose-color, on included pedicels: akene broadly ovate, a line long or less, dull and minutely granular.

A European species very widely naturalized, growing about yards and roadsides; apparently not yet common in California.

6. **P. minimum,** Watson. Very low and slender, ascending, rarely 6 inches high, usually more or less scabrous-puberulent: stems nearly terete, reddish: leaves ovate to oblong, sometimes all narrowly lanceolate, half an inch long or less, acute or apiculate: flowers in all the axils, usually small, a line long or less, erect on

slender exserted pedicels, often tinged with rose-color: stamens 5 to 8: akene smooth and shining, exceeding the sepals. — Bot. King Exp. 315. *P. Torreyi*, Watson, Am. Naturalist, vii. 664.

In the mountains of Northern California and Oregon, and eastward in the Wahsatch and Uintas (*Watson*); in the Sierra Nevada from the Yosemite Valley northward (*Torrey, Lemmon*); on Mount St. Helena and Scott Mountains, *Greene.*

+ + *Branches slender and virgate, angled, terminating in more or less open spikes, the narrow leaves diminishing upward and becoming bract-like.*

7. **P. ramosissimum,** Michx. Erect or ascending, usually 2 to 4 feet high, often branching only above, glabrous, the whole plant yellowish: sheaths loose and scarious, becoming lacerate to the base: leaves lanceolate to linear, 1 to 2½ inches long, acute, attenuate to a slender base: flowers and fruit as in *P. erectum*, 1 or 2 lines long, erect, the sepals more frequently 6, stamens 3 to 6, and akene usually smooth and shining. — Meisner, DC. Prodr. xiv. 97.

In the lower Sierra Nevada, ranging northward to the Columbia and across the continent, more common east of the mountains.

8. **P. tenue,** Michx. Erect and slender, ½ to 1½ feet high, glabrous and somewhat glaucous, sometimes slightly scabrous at the nodes: sheaths with a close somewhat herbaceous base, sparingly scarious and lacerate above: leaves linear to lanceolate, an inch or two long, acute at each end and often cuspidate, obscurely 3-nerved, usually much reduced above: flowers often solitary and usually distant, soon reflexed, 1 to 1½ or 2 lines long, the sepals margined with white or rose-color: stamens 8: styles a third as long as the ovary: akene ovate, black and shining. — Meisner, l. c. 100; Watson, l. c.

In the Cuyamaca Mountains (*Palmer*) and Sierra County (*Lemmon*); very common eastward, from British Columbia to Arizona, and across the continent. A broader leaved form occurs, often low (var. *latifolium*, Engelm.), and also a low slender variety with minute flowers and fruit (var. *microspermum*, Engelm.).

9. **P. coarctatum,** Dougl. Resembling the last in habit, but scabrous-puberulent and the stems often brown: sheaths with a short mostly scarious base and a more conspicuous lacerate summit: leaves linear, 1-nerved, acute: flowers more crowded and usually erect, the perianth more colored, rose-color or white: styles as long as the ovary. — Meisner, l. c. 101; Watson, l. c. 665.

Near Borax Lake (*Torrey*) and Donner Lake (*Lemmon*), and northward to the British boundary.

* * * *Annuals, low and slender: flowers in short dense spikes, with imbricated bracts: sepals colored, appressed: leaves linear.*

10. **P. imbricatum,** Nutt. Stems 1 to 8 inches high, smooth or slightly scabrous at the nodes, somewhat angled, often diffusely branched: sheaths rather large, 2-parted or lacerate above the short scarious base: leaves a half to an inch long, acute, 1-nerved: bracts loosely imbricated, linear or oblong, acute, 2 to 4 lines long, with sometimes a narrow scarious margin: flowers nearly sessile, a line long or less, rose-colored or white: stamens 3 or 5: styles a third as long as the ovary: akene three fourths of a line long, minutely tuberculate-striate or smoothish. — Watson, l. c. 665.

Frequent in the mountains, alpine and sub-alpine, from Donner Lake (*Torrey*) to the Columbia River, and eastward to Colorado. It has usually been referred to *P. coarctatum.*

11. **P. polygaloides,** Meisner, l. c. Spikes closer, the closely imbricated bracts oblong to nearly orbicular, with broad scarious margins, mostly obtuse: stamens 8: styles as long as the ovary. — Watson, l. c.

Oregon and Central Idaho, collected by *Spalding, Pickering,* and *Howell,* probably to be found in Northern California.

§ 2. *Flowers spicate, solitary and sessile in the axils of foliaceous bracts: leaves and bracts not jointed at base, striately 3-nerved; stipules fimbriate or 2-lobed: perianth colored, 5-parted, at length appressed to the triangular akene: stamens* 8; *inner filaments scarcely dilated: styles* 3, *persistent. Very slender low erect branching annuals, with narrow rigid leaves.* — DURAVIA, Watson.

12. **P. Californicum,** Meisner. Stems 3 to 6 inches high, striate and brownish, glabrous or minutely scabrous: leaves linear to filiform, 6 to 15 lines long, cuspidate: spikes very slender, elongated, the bracts subulate, 1 or 2 lines long; stipules sheathing, deeply lacerate-fringed, a line long, nearly equalling the rose-colored flowers: akene narrowly lanceolate, slightly exserted; styles slightly divergent. — DC. Prodr. xiv. 100; Watson, l. c., the fruit described from immature specimens.

Central California (Sacramento Valley and in the Sierra Nevada) to the Columbia River (*Nuttall*), on dry soil, rather frequent. Two additional members of this section are described on page 479.

§ 3. *Flowers fascicled, in usually dense spikes, with small scarious bracts: leaves not jointed on the petiole, pinnately many-veined: sheaths cylindrical and truncate, scarious, entire, naked or ciliate-fringed or margined: perianth colored, 5-parted, appressed to the lenticular or triangular akene: stamens* 4 *to* 8; *filaments filiform: stigmas* 2 *or* 3. — PERSICARIA, Linn.

* *Sheaths and bracts not ciliate nor fringed: sepals not punctate: style* 2*-cleft and akene flattened or lenticular.*

13. **P. nodosum,** Persoon. Annual, often stout, 1 to 4 feet high, branching, mostly glabrous, often sparingly and minutely glandular on the peduncles: leaves rather narrowly lanceolate, attenuate upward from near the base and acuminate, cuneate at base and shortly petioled, somewhat scabrous with short prickly hairs on the midrib and margins: spikes axillary and terminal, oblong and erect or often linear and nodding, an inch long or more: flowers white or light rose-color, a line long or nearly so: stamens 6, and styles 2, included: akene ovate, less than a line broad. — Meisner, l. c. 118.

In moist places; San Jose Valley and Santa Cruz (*Brewer*) and Alameda County (*Kellogg*), also in Oregon (*Hall*) and New Mexico (*Fendler*) — a form apparently identical with that of Europe and Asia. Farther eastward it has more attenuated spikes and larger leaves, perhaps running into *P. incarnatum,* Ell.

P. PENNSYLVANICUM, Linn. A similar species, but the branches above and especially the peduncles beset with stipitate glands: flowers larger and bright rose-color, in short erect spikes, often on exserted pedicels: stamens usually 8: style bifid, exserted: akene nearly orbicular, over a line broad. — Common in the Atlantic States and west to Colorado and Sonora (*Thurber*), and to be expected in California, at least as an introduced weed.

14. **P. amphibium,** Linn. Perennial, aquatic, stout and glabrous or nearly so, not branching above the rooting base: leaves floating, thick, smooth and shining above, usually long-petioled, elliptical to oblong or sometimes lanceolate, acutish or acute, cuneate or cordate at base, 2 to 5 inches long: sheaths leaf-bearing at about the middle: spike terminal, dense, ovate or oblong, a half to an inch long, on a usually short peduncle: flowers bright rose-color, $1\frac{1}{2}$ to 3 lines long, the 5 stamens and 2-cleft style exserted: akene lenticular, smooth. — Meisner, l. c. 115.

Perhaps not found west of the Sierra Nevada, but common in fresh waters about Mono Lake and Lake Tahoe, ranging northward to British Columbia, eastward across the continent, and to Mexico; in the Old World from W. Europe to China. In shallow water or on muddy banks the stems become erect, the petioles shorter, and the whole plant more strigose pubescent.

15. **P. Muhlenbergii,** Watson. Perennial, in muddy or dry places, scabrous with short appressed or glandular hairs, especially upon the leaves and upper part of the simple stem: leaves thinner, rather broadly lanceolate, narrowly acuminate, usually rounded or cordate at base, 4 to 7 inches long: spikes more elongated, 1 to

3 inches long, often in pairs: flowers and fruit nearly as in the last. — *P. amphibium*, var. *terrestre*, Gray, Manual, 416, and others; not of Willdenow. *P. amphibium*, var. (*t*) *Muhlenbergii*, Meisner, l. c. 116.

In Washington Territory and Oregon, and collected in California (*Bloomer*) but locality not given — extending eastward to the Atlantic Coast and Texas.

* * *Sheaths and bracts bristly ciliate or the sheaths sometimes foliaceously margined.*

+ *Sepals not punctate: style 2-cleft, and akene somewhat flattened.*

16. **P. Hartwrightii**, Gray. Perennial, closely allied to the two preceding species, growing usually in mud, the ascending stems rooting at base and very leafy: differing from the form of *P. ambiguum*, growing in like localities, by being more or less rough-hairy, at least on the sheaths and bracts, the former ciliate and often with abruptly spreading foliaceous borders; leaves rather narrow, 2 to 7 inches long, on very short petioles, adnate to the middle of the sheath. — Proc. Am. Acad. viii. 294.

Plumas Co. (*Mrs. M. E. P. Ames*); Utah (*Watson, Ward*); and eastward through the Northern States. It varies greatly in hirsuteness and in the characters of the sheath, and when growing in water the lower leaves are thick, smooth, and floating, approaching *P. amphibium* too closely.

P. Persicaria, Linn. Resembling *P. nodosum*, but sheaths and bracts ciliate; leaves usually marked by a dark spot near the middle; spikes short, erect; flowers shortly pedicelled; style 2–3-cleft, and akene sometimes triangular. — A very common species in the Atlantic States, introduced from Europe; reported from California only in Bot. Beechey.

+ + *Sepals conspicuously dotted and leaves punctate: style mostly 3-parted, and akene triangular: juice very acrid.*

17. **P. acre**, HBK. Perennial, rooting and decumbent at base, 2 to 5 feet high, branching, smooth or somewhat scabrous with short appressed hairs: leaves lanceolate to linear-lanceolate, acuminate, attenuate to a very short petiole: sheaths and the short bracts bristly ciliate: spikes loose and filiform, 1 to 3 inches long, erect on long peduncles: flowers greenish white or purplish, a line long: stamens 8. — Nov. Gen. ii. 179; Gray, Manual, 416.

Common in the Atlantic States and ranging to Mexico and South America; collected in the San Jose Valley (*Brewer*), but perhaps introduced.

P. Hydropiper, Linn., is an allied annual species, with shorter acute or often obtuse leaves and more nodding spikes; stamens 6; style more frequently 2-parted, and akene consequently often compressed. — A European species which also ranges across this continent northward; found in Washington Territory and perhaps in Northern California.

§ 4. *Glabrous alpine or subalpine herbaceous perennials, with thick creeping rootstocks and simple stems: flowers in dense spike-like racemes; perianth colored, deeply 5-cleft, at length appressed to the triangular akene: stamens 8, with filiform filaments: styles 3, long: leaves pinnately veined; petioles not jointed: sheaths obliquely truncate, naked, as well as the scarious ovate or lanceolate bracts.* — Bistorta, Linn.

18. **P. Bistorta**, Linn. Stems usually a foot or two high: leaves few, the radical ones on long petioles, oblong-lanceolate to linear, acute at each end, 2 to 8 inches long, the cauline much reduced, mostly obtuse at base and sessile upon the sheath; the margin often slightly revolute: sheaths elongated: flowers $1\frac{1}{2}$ to $2\frac{1}{2}$ lines long, rose-colored to white, on slender pedicels, in very dense ovate to oblong spikes $\frac{1}{2}$ to $1\frac{1}{2}$ inches long and usually long-pedunculate: bracts ovate, acuminate: stamens and styles exserted: akene $1\frac{1}{2}$ lines long, smooth and shining. — Meisner, DC. Prodr. xiv. 125.

Throughout the northern hemisphere; frequent in meadows and on stream-banks in the Sierra Nevada at 6 -10,000 feet altitude.

19. **P. viviparum,** Linn. A similar species, but mostly dwarf and more exclusively alpine: flowers smaller, nearly sessile in linear spikes 1 to 3 inches long, at least the lower ones replaced by sessile bulblets a line long. — Meisner, l. c. 124.

As widely distributed as the last; in the Clover Mountains, Nevada (*Watson*), frequent on the peaks of Utah and Colorado, and doubtless to be found in the Sierra Nevada, though it seems not to have been collected south of the Cascade Mountains in Washington Territory, *Lyall.*

§ 5. *Herbaceous branching perennials with running rootstocks: flowers in terminal and axillary racemose panicles or cymelets; perianth colored, 5-parted, attenuate at base, at length loosely appressed to the triangular akene: stamens* 8; *filaments filiform: styles* 3, *short: leaves pinnately veined; petioles not jointed: sheaths naked, entire or bifid; bracts small.* — ACONOGONON, Meisner.

20. **P. polymorphum,** Ledeb. Stout, erect, 2 to 7 feet high, glabrous or nearly so: leaves ovate- to oblong-lanceolate, acuminate, cuneate or sometimes rounded at base, decurrent the whole length of the short petiole, 3 to 7 inches long, usually scabrous on the margin: panicles loose, many-flowered, nearly naked, longer than the leaves: flowers greenish white, a line or two long, exceeding the pedicels: akene equalling or longer than the scarcely appressed sepals. — Meisner, l. c. 139; Watson, Bot. King Exp. 317.

In the Sierra Nevada, in moist places, from the Yosemite Valley northward to Alaska; East Humboldt Mountains, Nevada (*Watson*), a wholly smooth form with narrower leaves. The species varies greatly, and several varieties occur in Europe and Northern Asia.

21. **P. Davisiæ,** Brewer. Erect or somewhat decumbent, a foot high or more, stout and leafy throughout, much branched, often flexuous, pubescent with short spreading hairs or somewhat glabrous: leaves scabrous-ciliate, ovate to oblong, 1 or 2 inches long, acute or obtuse, cuneate or rounded at base and mostly sessile: flowers few, yellowish or purplish green, in small axillary and terminal cymose clusters or panicles much shorter than the leaves: perianth 1½ to 2 lines long, with a very narrow base: pedicels very short: akene exserted. — Gray, Proc. Am. Acad. viii. 399.

In the Sierra Nevada, on dry slopes, from Alpine County (*Brewer*) to Oregon; first collected by *Miss N. J. Davis.*

§ 6. *Herbaceous annuals or perennials, with fibrous roots, mostly twining or climbing, and with cordate or sagittate leaves: flowers in loose panicles or racemes or in terminal or axillary clusters; perianth green with colored margins,* 5- (*rarely* 4-) *parted, enlarging or keeled in fruit: stamens mostly* 8: *styles or stigmas* 3. — TINIARIA, Meisner.

P. DUMETORUM, Linn., var. SCANDENS, Gray. A smooth perennial, twining high over bushes, with cordate or slightly halbert-shaped acute leaves, and flowers in slender axillary sparingly leafy racemes: perianth becoming 4 or 5 lines long in fruit, long-attenuate to the slender reflexed pedicel, the outer sepals strongly winged upon the keel: akene acutely triangular, 2 lines long. — From the Atlantic States to the Upper Missouri and Washington Territory (*Lyall*), may reach Northern California.

P. CONVOLVULUS, Linn. A low annual, twining or procumbent, minutely scabrous; leaves halbert-cordate, acuminate: flowers few, in axillary fascicles or small interrupted racemes, on very short pedicels: perianth in fruit 1½ or 2 lines long, equalling the akene, the outer sepals sharply keeled. — An introduced weed from Europe, to be expected in California.

4. NEMACAULIS, Nutt.

Flowers perfect, each with a free herbaceous bractlet. Perianth 6-cleft, colored, enclosing the akene. Stamens 3. Styles 3: stigmas capitate. Akene short-ovoid, obscurely 3-angled. Radicle lateral, accumbent upon and longer than the strongly

incurved orbicular cotyledons. — A slender annual, with spatulate white-woolly mostly radical leaves and no stipules, stems sparingly and divaricately branched, and very small flowers in crowded sessile subglobose clusters in the axils and along the naked branches.

1. **N. Nuttallii**, Benth. Stems prostrate or ascending, a half to a foot long, glabrate, reddish : leaves narrowly spatulate, an inch or two long, including the petiole, densely woolly on both sides, radical with usually a few small ones in the axils of the short oblong herbaceous verticillate bracts which subtend the branches : bractlets of the flower-clusters obovate to spatulate, a line long or less, the outer without flowers, the inner smaller, glabrous outside, very woolly within : flowers yellowish, less than a half line long and slightly exceeding the bractlets, shortly pedicellate, glabrous ; inner segments broadest : akene a third of a line long. — DC. Prodr. xiv. 23 ; Gray, Proc. Am. Acad. viii. 146. *N. denudata & foliosa*, Nutt. in Journ. Acad. Philad. 2 ser. i. 168.

On the sandy beach near San Diego, *Nuttall, Cooper, Cleveland.*

5. ERIOGONUM, Michx.

Flowers perfect, involucrate ; involucre campanulate, turbinate or oblong, 4 – 8-toothed or lobed, without awns, usually many-flowered (rarely 1 – few-flowered) ; the more or less exserted pedicels intermixed with scarious narrow or setaceous bracts or bractlets. Perianth 6-parted or deeply 6-cleft, colored, enclosing the akene. Stamens 9, upon the base of the perianth. Styles 3 : stigmas capitate. Akene triangular (rarely lenticular), sometimes 3-winged. Embryo straight and axile, or (in all Californian species) more or less excentric and incurved ; cotyledons foliaceous, mostly shorter than the radicle. — Annuals and herbaceous or somewhat woody perennials, with radical or alternate or verticillate entire leaves, without stipules ; varying greatly in habit of growth, but readily distinguishable from other genera. The 99 species are confined exclusively (excepting two in the Southern Atlantic States and two Mexican ones) to the region between the Mississippi River and the Pacific Ocean. — Torr. & Gray, Revis. Eriog. in Proc. Am. Acad. viii. 146. Watson, Proc. Am. Acad. xii. 254.

* Involucres nerveless, 4 – 8-lobed or -toothed : bracts foliaceous, 2 to 5 or more, not regularly ternate.

Perennials : peduncle naked, or verticillate-bracteate in the middle (in nos. 2, 3 & 13), bearing a simple or compound umbel or head or a solitary involucre : base of flower stipe-like.
Involucres deeply lobed ; lobes becoming reflexed.
Flowers pubescent : involucres mostly solitary : low, cespitose, with leaves tomentose both sides.
Dwarf, densely matted : leaves ovate- to oblong-spatulate. — 1. E. CÆSPITOSUM.
Larger, more diffuse : peduncles (3 or 4 inches high) with a whorl of leaves in the middle. — 2. E. DOUGLASII.
Similar, but leaves linear-spatulate, often revolute : often with 2 – 4-rayed umbel, lateral rays bracteate. — 3. E. SPHÆROCEPHALUM.
Flowers glabrous : umbel simple or compound : diffusely branched at base ; leaves glabrate above, oblanceolate or spatulate.
Tomentose : umbel simple, of 3 to 10 naked rays. — 4. E. UMBELLATUM.
Glabrous : umbel few-rayed, the lateral rays bracted in the middle and often divided. — 5. E. TORREYANUM.
Tomentose : rays 2 to 4, usually and often repeatedly cymose-divided ; nodes all bracteate. — 6. E. STELLATUM.

Flowers glabrous : umbels usually compound : peduncles from a thick short caudex : leaves round to oblong.
Leaves oblong-ovate and cordate : peduncle stout, tall : umbel compound, of 6 to 10 elongated rays. 7. E. COMPOSITUM.
Leaves oval or rounded : peduncle decumbent : rays few, usually very short and undivided. 8. E. LOBBII.
Involucres with short erect teeth.
Flowers villous : dwarf, with a short thick caudex : umbel simple of 1 to 4 short rays : leaves glabrous. 9. E. PYROLÆFOLIUM.
Flowers glabrous : diffusely branched at base.
Umbel compound, villous-tomentose : bracts conspicuous. 10. E. URSINUM.
Umbel simple, tomentose, 5–8-rayed, often subcapitate : bracts and leaves small.
Somewhat cespitose : leaves oblanceolate, shortly petioled. 11. E. INCANUM.
More diffuse : leaves ovate or oblong. 12. E. MARIFOLIUM.
Involucre solitary on a leafy-bracteate peduncle. 13. E. KELLOGGII.
Slender annuals : involucres unequally 4-cleft, pedicellate, in diffuse di- or trichotomous cymes or panicles : flower not attenuate at base.
Leaves and bracts linear-oblanceolate, hirsute : involucres 1–2-flowered : flowers nearly glabrous. 14. E. SPERGULINUM.
Bracts oblong, hispid : involucres 3–5-flowered ; flowers very hirsute. 15. E. HIRTIFLORUM.

* * Involucres nerveless, with 5 rounded erect teeth, pedicellate, in diffuse di- or trichotomous cymose umbels or panicles : bracts ternate, mostly small, triangular and rigid : flower not with stipe-like base. Annuals, mostly glabrous above, with radical rounded leaves.

Leaves all radical, or nearly so.
Flowers glabrous ; outer segments broad and subcordate, the inner much smaller : pedicels very short, deflexed : leaves tomentose.
Procumbent, glandular, rather rigid. 16. E. BRACHYPODUM.
More erect, glabrous above the leaves. 17. E. DEFLEXUM.
Flowers glabrous ; outer segments oblong or broader above, the inner narrower : pedicels longer : leaves tomentose.
Pedicels deflexed : outer segments scarcely broader above.
Sparingly branched, low : pedicels minutely glandular : involucres campanulate. 18. E. NUTANS.
More diffuse, taller : pedicels glabrous : involucres narrowly turbinate : leaves obtuse. 19. E. WATSONI.
Involucres turbinate-campanulate : leaves acute : flowers more attenuate at base ; outer segments broader above. 20. E. CERNUUM.
Pedicels erect or spreading : outer segments much broader and rounded above. 21. E. THURBERI.
Flowers mostly minutely glandular-hispid, longer than the involucre ; outer segments mostly ovate : pedicels long and filiform.
Leaves floccose-tomentose : stem not inflated.
Greenish bracts and hemispherical involucres minutely glandular : leaves rounded : akene thick-lenticular. 22. E. PUSILLUM.
Bracts ciliate : involucres smooth, turbinate-campanulate : leaves reniform or cordate. 23. E. RENIFORME.
Bracts glabrous, minute : involucres glabrous : leaves rounded-ovate : outer segments of perianth often becoming much dilated at base. 24. E. THOMASII.
Leaves villous-pubescent : stem sometimes inflated.
Diffusely much-branched, very slender ; stem rarely inflated : involucres minute : flowers ½ line long. 25. E. TRICHOPODUM.
Less branched and internodes more elongated ; stem usually inflated : flower and akene a line long. 26. E. INFLATUM.
Leaves commonly at the nodes, in the axils of the bracts.
Tomentose : branches 4–6-angled : upper leaves lanceolate : involucres hemispherical. 27. E. ANGULOSUM.

* * * Involucres 5–6-nerved, with as many short erect teeth, sessile (rarely pedicellate) and erect : bracts ternate, short and rigid, sometimes foliaceous : flowers not with stipe-like base : more or less white-tomentose.

Segments of perianth very unequal, the outer broad and subcordate: cespitose perennials: inflorescence capitate or cymose-umbellate.
- Densely cespitose: leaves round or oblong: head solitary, rarely cymose. — 28. E. OVALIFOLIUM.
- Caudex more diffuse: leaves oblanceolate, acute: umbel 3-rayed, sparingly divided. — 29. E. DICHOTOMUM.

Segments similar, nearly equal, narrow at base.
- Perennials with short-branched caudex and naked peduncles: bracts small: heads or fascicles solitary, or few in a long-jointed cymose panicle (involucres sometimes solitary).
  - Dwarf, densely cespitose: head solitary: leaves small, linear-oblong. — 30. E. KENNEDYI.
  - Peduncles mostly tall and stout: caudex less branched.
    - Heads large and dense, 1 or few: peduncle very stout, not fistulous; tomentose. — 31. E. LATIFOLIUM.
    - Heads smaller, more numerous: leaves at least tomentose: peduncles more slender, fistulous. — 32. E. NUDUM.
    - Leaves large, villous: peduncles tall, fistulous, smooth. — 33. E. ELATUM.
- Woody branched perennials: stems very leafy: leaves fascicled and bracts mostly foliaceous: heads more or less closely cymose-umbellate.
  - Flowers villous: leaves round to oblong, obtuse: bracts short: heads few and open. — 34. E. CINEREUM.
  - Flowers glabrous: leaves ovate to oblong, acute: bracts conspicuous: heads few, close. — 35. E. PARVIFOLIUM.
  - Leaves narrowly oblanceolate, acute: umbel short and cymose, often much contracted or capitate. — 36. E. FASCICULATUM.
- Involucres solitary (terminal and alar) in a repeatedly divided corymb-like cyme: bracts mostly small: leaves not fascicled.
  - Perennial and woody.
    - Low and diffuse, slender: leaves oblanceolate to linear: umbel short. — 37. E. MICROTHECUM.
    - Stouter, more rigid, densely tomentose: leaves larger and broader: umbel broadly cymose. — 38. E. CORYMBOSUM.
  - Annual: leaves mostly rosulate at base.
    - Floccose-woolly throughout: leaves oblanceolate: involucres 2 lines long. — 39. E. TRUNCATUM.
    - Glabrous above: leaves rounded, small: involucres a line long: flowers minute. — 40. E. MOHAVENSE.
    - Hirsute: leaves rounded: involucres glandular. — 41. E. LEMMONI.
- Involucres solitary along the often virgate branches of a naked dichotomous panicle: bracts mostly small.
  - White-tomentose perennials: panicle sparingly branched, usually virgate: involucre tomentose, teeth not margined.
    - Much branched at base: leaves oblanceolate, acute, often fascicled: bracts small, triangular. — 42. E. WRIGHTII.
    - Sparingly branched at base: leaves rounded: bracts larger, subfoliaceous: branches short. — 43. E. SAXATILE.
    - Sparingly branched: leaves lanceolate to ovate: involucres larger (3 lines long), distant on the few elongated branches. — 44. E. ELONGATUM.
  - Woody perennials: panicle diffuse with short rigid branchlets: involucres short, teeth more or less margined.
    - Glabrate above, divaricately branched, the branchlets subspinescent: involucres few, distant, campanulate. — 45. E. HEERMANNI.
    - Tomentose, taller: branchlets very short-jointed: involucres narrowly turbinate. — 46. E. PALMERI.
  - Annuals: leaves rosulate at base.
    - Tomentose throughout: branches virgate, few: involucres narrow, 2 lines long.
      - Leaves oblanceolate: branches elongated: flowers glabrous. — 47. E. VIRGATUM.
      - Leaves rounded: more diffuse: flowers villous. — 48. E. DASYANTHEMUM.
    - More slender and diffuse: involucres smaller.
      - Leaves rounded: rather diffuse, often glabrous: involucres narrow, 1½ lines long. — 49. E. VIMINEUM.

Leaves rounded: very diffusely much-branched, often glabrous: involucres and flowers very small. 50. E. Baileyi.
Leaves oblanceolate: more erect and virgate, tomentose: involucres short, turbinate: bracts more produced. 51. E. gracile.
Leaves rounded: intricately much-branched, tomentose: involucres very small: flowers larger, the segments broadly cuneate, retuse. 52. E. Plumatella.

§ 1. *Involucres herbaceous and nerveless, more or less broadly turbinate (mostly 2 lines long or more), 4 – 8-toothed or -lobed: bracts foliaceous, indefinite in number (2 to 5 or more). Mostly perennial.* — Eueriogonum, Watson.

* *Involucres in a simple or compound umbel, sometimes single or capitate: perianth attenuate to a more or less narrow and stipe-like base. Perennials, often woody at base, with naked or leafy-bracteate peduncles; leaves mostly woolly, at least beneath; filaments pubescent at base; ovary usually somewhat hairy above.* — (§§ Umbellata, Benth., & Pseudo-umbellata, Torr. & Gray.)

+ *Involucres deeply lobed, the lobes becoming reflexed.*

++ *Perianth villous or pubescent: involucre solitary, without bracts (rarely umbelled in* n. 3*): low and cespitose, with yellow flowers, and leaves tomentose both sides.*

1. **E. cæspitosum,** Nutt. Dwarf and densely matted, the short woody caudex much branched and usually crowded with old leaves: leaves ovate- to oblong-spatulate, 2 to 6 lines long, densely white-woolly, rosulate: peduncles scape-like, naked, 1 to 3 inches high, slender: lobes of the involucre linear-oblong, as long as the turbinate tube: flowers yellow, often tinged with purple, 1½ to 3 lines long including the stipe-like base; lobes oblong-oval. — Journ. Acad. Philad. vii. 50, t. 8; Torr. & Gray, Rev. Eriog. in Proc. Am. Acad. viii. 157.

On mountain sides and in dry valleys from Northwestern Nevada to Wyoming Territory.

2. **E. Douglasii,** Benth. Somewhat larger, stouter and more diffuse, the leaves sometimes an inch long: peduncles 3 or 4 inches high, with a whorl of 4 to 6 oblanceolate leaves in the middle. — DC. Prodr. xiv. 9; Torr. & Gray, l. c.

In Sierra Valley, Sierra County (*Lemmon*); Blue Mountains, Oregon, *Douglas.*

3. **E. sphærocephalum,** Dougl. Still more diffuse and leafy-stemmed; leaves usually narrower and linear-spatulate, less tomentose above and margins often revolute: peduncles 2 to 4 inches long, with a central whorl of leaves and solitary involucre, or the whorl subtending a 2 – 4-rayed umbel with the lateral rays also bracteate: flowers bright yellow or yellowish, 2 to 4 lines long including the slender stipe. — Benth. l. c. 8; Torr. & Gray, l. c.

Northern California (rocky hills about Yreka, *Greene*) and Nevada to Washington Territory.

E. thymoides, Benth., is most nearly allied to this group, though with the short involucral lobes apparently always erect: dwarf, densely branching and woody, with revolute-linear leaves 1 to 5 lines long; peduncles slender, 1 to 3 inches high, with a whorl of similar leaves in the middle; flowers densely long-villous, purplish, 2 or 3 lines long, with rather broad lobes. — Oregon (Union County, *Cusick*) and Washington Territory, *Pickering, Lyall.*

++ ++ *Perianth glabrous, with elongated base: peduncles from a more or less diffusely branched woody base: umbel simple or compound (involucre rarely solitary in* n. 4*): leaves not large, often glabrous or glabrate at least above.*

4. **E. umbellatum,** Torrey. More or less tomentose, at least the upper side of the leaves glabrate: leaves obovate- to oblong-spatulate or oblanceolate, an inch or two long or often smaller, margins not revolute nor undulate: peduncles 3 to 12 inches high or more, naked, bearing a simple umbel of 3 to 10 naked usually short rays, subtended by a whorl of leaves: lobes of the involucre usually shorter than the

turbinate tube: flowers yellow or yellowish, 2 or 3 lines long. — Ann. Lyc. N. Y. ii. 241 & Sitgr. Rep. t. 12; Benth. l. c. 11; Torr. & Gray, l. c. 160.

Var. **monocephalum**, Torr. & Gray, l. c. A dwarf alpine or high-mountain form, with the umbel reduced to a single ray, i. e. the naked or bracteate peduncle bearing a solitary involucre: leaves small. — *E. Tolmieanum*, Hook. Fl. Bor.-Am. ii. 134; Benth. l. c.

A common species in the mountains of Northern California and Oregon, and eastward to the Rocky Mountains, at 6,000 to 10,000 feet altitude.

5. **E. Torreyanum**, Gray. Glabrous throughout excepting the involucre-lobes: leaves obovate- to oblong-spatulate, an inch or two long, rather thick: peduncles stout, naked or rarely with a single leaf in the middle, 6 to 10 inches high, bearing a few-rayed umbel; lateral rays leafy-bracted in the middle and often divided: flowers large (3 or 4 lines long), yellow often tinged with purple: ovary glabrous. — Torr. & Gray, l. c. 158.

In the Sierra Nevada, from Silver Mountain northward, *Torrey, Kellogg, Lemmon*, etc.

6. **E. stellatum**, Benth. More or less tomentose, the stems rather more diffuse and leafy: leaves ovate-spatulate to oblanceolate: peduncle naked, 6 to 12 inches high, bearing an umbel of 2 to 4 mostly elongated rays which are usually and often repeatedly divided in a cymose manner; the nodes and lateral rays all leafy-bracted: flowers as in *E. umbellatum*. — Linn. Trans. xvii. 409; Hook. Fl. Bor.-Am. ii. 134, t. 177. *E. ellipticum*, Nutt. Pl. Gambel. in Journ. Acad. Philad. n. ser. i. 161. *E. polyanthum*, Benth. in DC. Prodr. xiv. 12; Torr. & Gray, l. c. 158.

Var. **bahiæforme**. Inflorescence much branched; leaves mostly small and often densely tomentose on both sides. — *E. polyanthum*, var. *bahiæforme*, Torr. & Gray, l. c. 159.

In the mountains from Oregon to Southern California, chiefly in the Sierra Nevada, more rarely in Arizona and S. Utah (*Anderson, Palmer, Wheeler*); the variety near Fort Tejon (*Horn, Rothrock*) and on Mt. San Carlos, *Brewer*. Distinguished from *E. umbellatum* principally by the character of the inflorescence.

E. HERACLEOIDES, Nutt.; Torr. & Gray, l. c. 159. A similar species, densely tomentose with the upper side of the narrowly oblanceolate leaves somewhat glabrate, and the peduncle nearly always with a whorl of leaves in the middle, the margin of all the leaves usually somewhat revolute or undulate; umbel about 6- (1–11-) rayed, sometimes simple, usually with some or all of the rays once or rarely twice divided; flowers often smaller. — From the eastern part of Washington Territory to Nevada and Utah, and may reach Northeastern California.

++ ++ ++ *Perianth glabrous: peduncles stout and naked, from a thick and short sparingly branched caudex: umbel usually compound: leaves large, broadly ovate or oblong.*

7. **E. compositum**, Dougl. More or less white-tomentose: leaves very densely tomentose beneath, greener above, oblong-ovate, cordate at base, acute or acutish, 1 to 3 inches long, on slender elongated petioles: peduncle very stout and fistulous, erect, ½ to 1½ feet high, nearly glabrous: umbel of 6 to 10 more or less elongated rays, each bearing a short several-rayed umbellet, subtended by whorls of linear-oblanceolate leaflets: flowers dull white or rose-colored, 2 to 4 lines long. — Benth. l. c. 11; Torr. & Gray, l. c. 159.

From Washington Territory to Idaho and Northern California; on volcanic rocks near Long Valley, Mendocino County, *Bolander*.

8. **E. Lobbii**, Torr. & Gray. Cespitose, the very thick caudex scarcely branched, tomentose: leaves oval or rounded, ½ to 1½ inches long on rather stout petioles, thick and densely tomentose or somewhat glabrate above: peduncles 3 to 8 inches high, decumbent: umbel of a few (about 3) stout and usually very short rays, subtended by 3 or 4 oblong or oblanceolate leaflets connate at base, the rays sometimes divided: involucres very large, nearly half an inch long: flowers rose-colored, 2 or

3 lines long, more shortly stipitate at base: akene smooth. — Proc. Am. Acad. viii. 162.

Alpine or subalpine in the Sierra Nevada, from Silver Mountain (*Brewer*) to Siskiyou County, *Greene.*

+– +– *Involucre with short teeth, erect or nearly so: peduncles naked (except in* n. 13).

++ *Perianth villous: peduncles from a short and thick sparingly branched caudex: umbel simple.*

9. **E. pyrolæfolium,** Hook. Leaves thick, glabrous, round-obovate to oblong, 3 to 9 lines broad, mostly abruptly attenuate into a short petiole, broad and villous at base: peduncles smooth, 2 or 3 inches high, bearing a 2-bracteate umbel of 1 to 4 very shortly pedicellate involucres, which are sinuately toothed and villous: flowers rose-colored, 1½ to 2 lines long, rather sparingly hairy. — Kew Journ. Bot. v. 395, t. 10; Torr. & Gray, l. c. 162.

Mount Shasta (*Jeffrey*) and Lassen's Peak, in volcanic ashes, *Lemmon.* A more tomentose form with narrower and densely tomentose leaves (var. *coryphæum,* Torr. & Gray, l. c.) was collected by *Lyall* in the Cascade Mountains.

E. FLAVUM, Nutt. Tomentose throughout, with oblanceolate long-petioled leaves, and rather slender peduncles 3 to 8 inches high: umbel simple, of 3 to 9 rays an inch long or usually much shorter, sometimes reduced to a head of (one to several) nearly sessile involucres: bracts 3 to 8, oblanceolate: involucre large, repandly toothed often obscurely, becoming brown and somewhat membranaceous: flowers yellow, very villous, 2 or 3 lines long. — Torr. & Gray, l. c. 156. *E. crassifolium,* Benth. in Hook. Fl. Bor.-Am. ii. 134, t. 176. A common species, ranging from Washington Territory and Oregon to the Saskatchewan and Western Arkansas, and may be found in Northern California.

++ ++ *Perianth glabrous: peduncles from a diffusely branched woody base.*

= *Umbel compound, villous-tomentose: bracts conspicuous.*

10. **E. ursinum,** Watson. Densely tomentose, the peduncle and umbel somewhat villous: leaves ovate, acute, 4 to 6 lines broad, cordate or cuneate at base, exceeding the petiole, greener above: peduncles stout, 6 to 12 inches high: umbel 6–12-rayed, with elongated oblanceolate or linear bracts: involucres large and turbinate, sharply toothed: flowers pale, 1½ to 2½ lines long: filaments very villous. — Proc. Am. Acad. x. 347.

In the Northern Sierra Nevada; Plumas County, apparently abundant, *Lemmon, Mrs. M. E. P. Ames.*

= = *Umbel simple, tomentose, the central involucre sessile or all subcapitate: bracts small.*

11. **E. incanum,** Torr. & Gray. Somewhat cespitose and matted, tomentose: leaves oblanceolate or oblong-spatulate, a half to an inch long, on short petioles: peduncles slender, 2 to 8 inches high: umbel of 5 to 8 slender rays, subtended by a few small linear bracts, the central involucre sessile, or the umbel reduced to a small head: involucres small (1½ lines long), strongly toothed: flowers yellow, often tinged with red, 1 to 3 lines long. — Proc. Am. Acad. viii. 161.

In the Sierra Nevada, Mariposa and Tuolumne counties, at 8,000 to 11,000 feet altitude.

12. **E. marifolium,** Torr. & Gray, l. c. Very slender, tomentose, the base diffusely branched: leaves ovate to oblong, 3 to 6 lines long, densely tomentose both sides or at length glabrous above: peduncle 2 to 12 inches high: umbel of 5 to 8 reduced or sometimes much elongated rays, with short linear bracts: involucre a line long: flowers yellow or yellowish, 1 to 2½ lines long, the smaller apparently only staminate.

In the Sierra Nevada, from Mariposa County to Mount Shasta, at 7,000 to 9,000 feet altitude; also near Pyramid Lake, Nevada, *Lemmon.*

= = = *Peduncle leafy-bracteate in the middle, bearing a solitary involucre.*

13. **E. Kelloggii,** Gray. Low and very slender, villous-tomentose: leaves oblanceolate, 2 to 4 lines long, scarcely petiolate: peduncles 2 to 4 inches high, with a central whorl of 3 to 5 foliaceous bracts and bearing a single naked rather large strongly-toothed involucre (2 lines long): flowers rose-colored or whitish, 1½ to 2½ lines long. — Proc. Am. Acad. viii. 293.

In fir-woods on Red Mountain, Mendocino County, *Kellogg & Harford.*

* * *Involucres unequally 4-lobed, mostly small, pedicellate in di- or trichotomous cymes or panicles (or sometimes sessile in the forks): perianth not long-attenuate at base. Mostly leafy annuals: filaments and ovary glabrous.* — (§ Foliosa, Benth.)

14. **E. spergulinum,** Gray. Very slender, 3 inches to 2 feet high, diffusely branched usually from the base, slightly glandular-hispid or nearly glabrous: lower leaves scattered near the base, thin, linear-oblanceolate, ½ to 2 inches long, more or less hirsute, the margin somewhat revolute; bracts similar: pedicels very slender, 3 to 6 lines long, spreading: involucres turbinate, ¼ line long, deeply 4-cleft, glabrous, 1 – 2-flowered: bractlets none: flowers exserted, rose-colored, ½ to 1 line long, slightly glandular-puberulent at base; segments cuneate-oblong, the outer obtuse or retuse, the inner erosely 3-toothed: akene obovoid or lenticular. — Proc. Am. Acad. vii. 389; Torr. & Gray, l. c. 189.

In the Sierra Nevada at 6,000 to 10,000 feet altitude, frequent, from Sierra County (*Lemmon*) to Tulare County, *Rothrock.*

15. **E. hirtiflorum,** Gray. Diffusely branched, 6 inches high or less, somewhat glandular-puberulent and viscid: bracts hispid, oblong, 3 lines long or less, acutish: involucres turbinate, half a line long or less, 4-parted, on slender erect or nodding pedicels 1 to 3 lines long, or in the forks often nearly sessile: flowers 3 to 5, very hirsute, yellowish tinged with red, ½ line long; segments oblong, obtuse: akene triangular, exserted. — Watson, Proc. Am. Acad. xii. 259.

Collected by *Dr. Gray,* in 1872, and by *Hooker & Gray* in 1877, in Tuolumne County, at 2,500 to 5,000 feet altitude.

E. pharnaceoides, Torrey in Sitgreaves, Rep. 167, t. 11. Tall and hoary-tomentose, leafy and rather sparingly branched: leaves linear-oblanceolate, smoother above, with revolute margin, an inch long or more: involucres on elongated pedicels, turbinate, deeply 6 – 8-cleft, 1 to 1½ lines long, 8 – 12-flowered: flowers glabrous, whitish, a line long; outer segments ovate, at length bigibbous at base, the inner linear-oblong, retuse. — Fort Whipple, Arizona (*Palmer*), and eastward to New Mexico.

E. Abertianum, Torrey, and E. villiflorum, Gray, may also perhaps be found on the southeastern borders of the State, both villous species with deeply cleft involucres. The first an erect branching annual, with ovate or subcordate leaves, the upper lanceolate or linear; involucres 4 – 8-cleft, 1½ lines long, scattered along the branches; flowers rose-colored, glabrous, the outer segments round-cordate, becoming 2 lines long, the inner linear-oblong: E. Arizona and New Mexico. The second is a dwarf cespitose perennial, with small oblanceolate leaves crowded on the very short branches of the thick caudex, and each branch terminated by a slender peduncle (an inch long) bearing a loose cymose head; involucres 6-cleft, 2 lines long: flowers silky within and without, a line long, 6-cleft to the middle; the lobes oblong and nearly equal: S. Utah, *Siler, Parry.*

§ 2. *Involucres mostly campanulate or short-turbinate, small, not angled and very rarely obscurely nerved, with 5 rounded erect often membranously margined teeth, pedicellate in diffuse repeatedly di- or trichotomous cymose umbels or panicles, usually more or less deflexed or spreading: bracts ternate, not foliaceous, small and mostly triangular and rigid: perianth not attenuate at base. Slender annuals (the Californian species), with radical and rounded leaves: inflorescence and involucres usually glabrous: filaments and ovaries glabrous.* — Ganysma, Watson.

* *Leaves all radical, only rarely occurring in the axils of the bracts.* — (§ PEDUNCULATA, Benth.)

+– *Outer segments of the glabrous perianth broad and subcordate at base, the inner much smaller: pedicels very short, deflexed: leaves floccose-tomentose.*

16. **E. brachypodum,** Torr. & Gray. Low and depressed, very divaricately much-branched and rather rigid, beset throughout (except the leaves) by scattered short glandular hairs: leaves densely tomentose both sides, orbicular, 3 to 6 lines in diameter: stem very short: involucres turbinate-campanulate, half to two thirds of a line long, on pedicels less than a line long, more or less deflexed: flowers a line long, rose-colored, the outer segments cordate-ovate, very obtuse, the inner half as wide, obtusely acuminate. — Proc. Am. Acad. viii. 180.

Collected only by *Remy* at Kingston Springs on the northeastern border of San Bernardino County.

17. **E. deflexum,** Torrey. Taller and more erect, becoming a foot or two high, glabrous above the leaves, which are orbicular, somewhat cordate at base, 6 to 15 lines broad: involucres and pedicels as in the last, but more secund along the branchlets: outer segments of the light rose-colored or yellowish perianth round-cordate, becoming a line long, the inner very small, obovate and retuse: pedicels reflexed, less than a line long, or rarely a line or more. — Ives' Rep. 24; Torr. & Gray, l. c. 181.

On the Mohave River (*Palmer*) and eastward to Utah and E. Arizona.

E. PARRYI, Gray, Proc. Am. Acad. x. 77, is another species of this group, belonging to S. Utah, resembling *E. brachypodum*, but less rigidly branched, the rather narrowly turbinate involucres a line long and on slender pedicels 1 to 3 lines long. E. HOOKERI and E. INSIGNE, Watson ined., also of Utah, are more nearly allied to *E. deflexum*.

+– +– *Outer segments of the glabrous perianth broadest above and somewhat panduriform, or oblong, emarginate or retuse, the inner ones narrower: pedicels longer: leaves floccose-tomentose.*

++ *Pedicels deflexed: outer segments oblong or somewhat broader above.*

18. **E. nutans,** Torr. & Gray, l. c. Slender, erect, 3 to 6 inches high, mostly glabrous except the leaves, sparingly branched and few-flowered: leaves rounded, obtuse or acutish, 3 or 4 lines broad: involucres campanulate, a line long, mostly glabrous, but the nodding pedicels minutely viscid-glandular, 2 to 4 lines long: flowers rose-colored, a line long, rather obtuse at base, the outer segments somewhat broader above and emarginate (nearly obcordate), the inner oblong and retuse. — Watson, Bot. King Exp. 307, t. 33.

Lassen County (*Beckwith*); Northwestern Nevada, *Watson, Lemmon.*

19. **E. Watsoni,** Torr. & Gray, l. c. More diffusely branched, a half to a foot high, glabrous; leaves rounded, obtuse, often somewhat cordate, a half to an inch broad: involucres narrowly turbinate, 1 to nearly 1½ lines long, attenuate into a slender spreading or reflexed pedicel 1 to 4 lines long: flowers light rose-color, rather abruptly attenuate at base, the outer segments oblong and often retuse, the inner slightly narrower.

In the West Humboldt Mountains, Nevada, *Torrey, Watson.*

20. **E. cernuum,** Nutt. Resembling the last, but with broadly ovate acute leaves, turbinate-campanulate involucres, and flowers more attenuate at base, the outer segments broader above and retuse, the inner oblong and narrower. — Pl. Gambel. 162; Benth. in DC. Prodr. xiv. 21; Torr. & Gray, l. c. 182.

Reported as collected by *Beckwith*, with *E. nutans*, on the eastern border of Lassen County, and by *Nuttall* in Oregon; E. Humboldt Mountains, Nevada (*Watson*), and frequent in Utah, Colorado and New Mexico.

++ ++ *Pedicels erect or somewhat spreading: outer segments much broader above.*

21. **E. Thurberi,** Torrey. Very slender, 6 inches high or less, the stem tomentose below the panicle: leaves rounded-ovate, obtuse, 3 or 4 lines long: bracts comparatively large and thick, spreading: pedicels very slender, a half to an inch long: involucres campanulate, nearly a line long, subviscidly puberulent: flowers rose-colored or white, half a line, becoming a line long; the outer segments with a large rounded terminal lobe, the inner small and lanceolate. — Bot. Mex. Bound. 176; Torr. & Gray, l. c. 183.

Southern California, Los Angeles to San Bernardino (*Thurber, Wallace, Parry*); near Camp Grant, Arizona, *Palmer*. The remaining species of this group, E. ROTUNDIFOLIUM, Benth., is rather stouter, more diffuse, and with larger leaves; pedicels shorter and more rigid; flowers from less than a line becoming 1½ lines long, the outer segments very broadly dilated above, the inner narrowly oblong: New Mexico and Western Texas.

+ + + *Perianth mostly minutely glandular-hispid or -puberulent, longer than the small involucre, the outer segments mostly ovate: pedicels long and filiform, rarely deflexed.*

++ *Leaves floccose-tomentose, not villous or silky: pedicels all in the forks or terminal: stem not inflated.*

22. **E. pusillum,** Torr. & Gray. Very variable in size, 2 to 20 inches high, becoming rather stout and diffusely much-branched: leaves rounded or obovate, obtuse, 6 to 12 lines broad, usually less tomentose above: the greenish bracts and involucres minutely glandular-hispid: pedicels smooth, 3 to 18 lines long or rarely more, comparatively rather stout: involucres hemispherical-campanulate, a half to a line long: flowers yellow or yellowish, often tinged with red, deeply parted, more or less glandular-puberulent, becoming a line long, the outer segments oblong-obovate, the inner oblong: akene short and compressed-globose. — Proc. Am. Acad. viii. 184; Watson, Bot. King Exp. 308.

A very peculiar species; of dry valleys, from Northwestern Nevada (*Watson, Lemmon*) to Arizona (*Palmer*) and San Bernardino County, California, *Newberry, Parry.*

23. **E. reniforme,** Torrey. Low and slender, glabrous: leaves small, reniform or cordate-orbicular and, with the petioles, densely white-tomentose both sides, not at all hairy: bracts smooth, the margins fimbriate with loose hairs: pedicels half an inch long or less: involucres smooth, turbinate-campanulate, nearly a line long: flowers apparently rose-colored, half a line long, glabrous, segments ovate-oblong, the inner a little smaller. — Fremont's Rep. 317; Benth. in DC. Prodr. xiv. 21; Torr. & Gray, l. c. 184, excluding Palmer's Arizona plant with smaller involucres.

Collected by *Fremont* "on the Sacramento," and by *Cooper* at Fort Mohave: imperfectly known. Specimens of *E. subreniforme* have been referred to it.

24. **E. Thomasii,** Torrey. Very slender, a span high or often much less, diffuse, glabrous: leaves rounded and ovate, half an inch long or less, usually less tomentose above: bracts minute, glabrous: pedicels filiform, 2 to 15 lines long: involucres glabrous, turbinate-campanulate, ½ to 1 line long: flowers yellowish or tinged with red, becoming two thirds of a line long, slightly hispid at base or glabrous, the outer segments at length often much dilated below, the inner linear-oblong or spatulate. — Pacif. R. Rep. iv. 364; Torr. & Gray, l. c. 184.

In the valley of the Colorado, from Fort Yuma to Fort Mohave and eastward to S. W. Colorado (*Brandegee*); eastern base of San Bernardino Mountains, *Parry.*

++ ++ *Leaves more or less villous-pubescent, not tomentose: pedicels often scattered and secund on the branchlets: stem often inflated.*

25. **E. trichopodum,** Torrey. Glabrous, diffuse, ½ to 1 foot high, the stem occasionally somewhat inflated; branches very slender: leaves round-cordate to

oblong-ovate, 3 to 12 lines long: bracts very small, smooth or ciliate: involucres minute (a third of a line long or less), turbinate-campanulate, glabrous, on very slender divaricately spreading pedicels 3 to 6 lines long: flowers few, half a line long, yellowish, pubescent; segments ovate-lanceolate, acute. — Emory's Rep. 151 (as *E. trichopes*); Benth. l. c. 20; Torr. & Gray, l. c. 185.

San Diego County, at Larken's Station near the southern boundary (*Palmer*); in the Colorado Valley, at Fort Mohave (*Cooper*), and eastward to S. Utah and New Mexico.

26. **E. inflatum**, Torrey. Taller, 1½ to 2 feet high, less branched but diffuse, the stem and internodes more elongated and usually more or less inflated, glabrous: leaves rounded, ½ to 1½ inches long, usually cordate and mostly undulate: pedicels 6 to 12 lines long: involucres and flowers nearly as in the last, but the latter as well as the akene larger, becoming over a line long. — Fremont's Rep. 317; Benth. l. c.; Torr. & Gray, l. c.

Southern California, and in the dry valleys of Western Nevada and Arizona; New Idria (*Brewer*); Fort Mohave, *Cooper*. The other allied species, but with stems never inflated, are

E. SUBRENIFORME, Watson, Proc. Am. Acad. xii. 260. (*E. reniforme*, Torr. & Gray, l. c. 184, in part.) Sparingly villous at the nodes, the round-reniform or -cordate leaves tomentose beneath and silky villous above; involucres turbinate-campanulate, glabrous, half a line long, equalling the glabrous or slightly hispid rose-colored flowers; segments oblong. — Arizona and S. Utah.

E. GORDONI, Benth. l. c. 20. Glabrous throughout or the petioles only slightly villous; flowers glabrous, light rose-colored, a line long, the outer segments ovate, the inner oblong; involucres as in the last. — Colorado.

E. GLANDULOSUM, Nutt. Beset with short stipitate glands; leaves somewhat villous, obovate, small; involucres glabrous, turbinate-campanulate, half a line long; flowers slightly hispid, nearly a line long, the segments oblong-ovate, acutish. — Probably in Colorado or New Mexico.

E. SCALARE, Watson, Proc. Am. Acad. xii. 261. Slender and glabrous, the branches and branchlets opposite or alternate (sometimes in threes), divaricate or ascending; bracts distinct, linear, acute, 1 or 2 lines long, spreading or reflexed, on the branchlets smaller and erect: pedicels scattered on the branchlets, 1 or 2 lines long, ascending, filiform: involucres narrowly turbinate, two thirds of a line long, glabrous; bracteoles spatulate, naked: flowers slightly pubescent, a line long; segments oblong, the inner a little narrower. — Canvas Point, coast of Lower California (*Streets*); known only from imperfect specimens.

* * *Leaves commonly developed at the nodes, in the axils of ordinary triangular bracts.* — (§ PSEUDO-STIPULATA, Torr. & Gray.)

27. **E. angulosum**, Benth. More or less floccose-tomentose, 3 to 15 inches high, diffusely branching from near the base, the branches mostly 4–6-angled: radical leaves orbicular to oblong-ovate, somewhat cordate or cuneate at base, obtuse and often undulate, ½ to 1 inch long, on rather short petioles; upper leaves oblong to lanceolate or oblanceolate, sessile or nearly so: involucres on filiform pedicels 3 to 15 lines long and mostly in the forks or terminal, hemispherical, a line or two broad, many-flowered, smooth or minutely glandular: bractlets mostly firm and dilated: flowers rose-colored or greenish, half a line long, nearly glabrous; outer segments ovate, concave, the inner longer, lanceolate. — Linn. Trans. xvii. 406, t. 18, f. 1; DC. Prodr. xiv. 22; Torr. & Gray, l. c. 187.

From the Lower Sacramento and Northern Nevada to Arizona and S. Utah; frequent in dry valleys and cañons.

§ 3. *Involucres cylindric-turbinate or prismatic, more or less strongly 5–6-nerved and with as many short erect teeth, often becoming costate or angled, rather large (1 to 3 lines long), sessile (or rarely some of them pedunculate), in heads or clusters or scattered in cymes or along virgate paniculed branches, always erect: bracts ternate, connate at base, usually short and acute and more or less rigid, sometimes more or less foliaceous: perianth more abruptly contracted to the base. Perennials, sometimes woody and leafy, with some annuals or biennials, more or less white-tomentose: ovary and filaments mostly glabrous.* — OREGONIUM, Watson.

* *Perianth glabrous, not attenuate at base, the outer lobes broad and somewhat cordate, the inner much narrower: cespitose perennials with a short and closely branched caudex, densely tomentose: involucres in a single head or short cyme upon the naked peduncle: bracts very small, rigid and acute: ovary scabrous above or the angles and filaments pilose.* — (§ HETEROSEPALA, Torr. & Gray.)

28. **E. ovalifolium,** Nutt. Low and densely cespitose: leaves orbicular, 2 to 6 lines broad, obtuse, rarely oblong or acutish, mostly abruptly narrowed into the slender petiole: peduncles slender, 2 to 9 inches high: involucres 3 to 8, in a single close head, 2 to 2½ lines long; flowers rose-colored, white, or yellow, 1½ to 2½ lines long, the outer lobes oblong becoming suborbicular, the inner spatulate and often retuse. — Journ. Acad. Philad. vii. 50, t. 8; Torr. & Gray, l. c. 164. *Eucycla ovalifolia & purpurea,* Nutt. Pl. Gambel. 166.

Var. **proliferum,** Watson. Involucres more or less diffusely cymose-umbellate. — Proc. Am. Acad. xii. 263. *E. proliferum,* Torr. & Gray, l. c. 164.

A very common and variable species in the mountains and on the foothills, mostly east of the Sierra Nevada, from California to the Rocky Mountains and northward to the British boundary; Scott Mountains, Siskiyou County (*Greene*), the variety, which is rather rare.

29. **E. dichotomum,** Dougl. Caudex more diffuse, with short leafy stems: ½ to 1½ feet high: leaves oblong or oblanceolate, acute at each end, an inch or two long, on slender petioles: peduncles rather stout, bearing a 3-rayed umbel, the somewhat erect rays sparingly di- or trichotomous: lower bracts often foliaceous; the upper appressed: involucres usually solitary, tomentose, about 3 lines long, strongly toothed: flowers white tinged with rose, 1½ to 2 lines long, the outer lobes broadly elliptical, the inner linear-spatulate. — Benth. in DC. Prodr. xiv. 14. *E. album,* Nutt. Pl. Gambel. 164. *E. Greenei,* Gray, Proc. Am. Acad. xii. 83.

Oregon; rocky hills about Yreka (*Greene*).

E. NIVEUM, Dougl., is a very similar species, distinguished by having most of the bracts more or less foliaceous and spreading, and by the usually shorter and broader involucre with some or all of the teeth produced and often recurved. — Washington Territory to Oregon and Idaho.

* * *Perianth narrower but not stipe-like at base, the lobes similar and nearly equal: ovary and filaments glabrous, or nearly so.*

\+ *Perennials, with short-branched scarcely woody caudex and naked peduncles: bracts mostly short and rigid: involucres capitate or fascicled (or sometimes solitary), the clusters mostly few, usually in a di- or trichotomous long-jointed cymose panicle.* — (§§ CAPITATA & CAPITELLATA, Torr. & Gray.)

\+\+ *Dwarf and densely cespitose: head solitary.*

30. **E. Kennedyi,** Porter. Densely white-tomentose, the numerous short branches compacted with the crowded old and new leaves: leaves narrowly oblong, revolute, 1½ to 3 lines long: peduncles very slender and wiry, glabrous, 2 to 4 inches high: involucres 2 to 10, somewhat tomentose, 1½ lines long, strongly nerved, with short teeth: flowers glabrous, white veined with red, 1½ lines long. — Watson, Proc. Am. Acad. xii. 263.

In Kern County, California, *W. L. Kennedy,* 1876.

E. KINGII, Torr. & Gray, l. c. 165 (excl. var.), has oblanceolate or spatulate leaves a half inch long on slender petioles, more loosely woolly; peduncles and involucres villous-tomentose, the latter deeply toothed and somewhat scarious; heads dense; flowers 1½ to 2 lines long. — On high mountains in Eastern Nevada, *Watson.* Several other species belonging to this group are found in the mountains of Utah and Colorado.

\+\+ \+\+ *Peduncles mostly tall and stout from a sparingly branched caudex.*

31. **E. latifolium.** Smith. Stout, tomentose throughout, the short branches of the indurated caudex usually very leafy: leaves oblong to ovate, an inch or two

long, obtuse or acute, at base rounded or cordate or rarely cuneate, the margin often undulate and upper surface becoming glabrate; petiole often short and margined: peduncles erect or ascending, 6 to 20 inches high and very stout, not fistulous: bracts triangular: heads large and dense, often compound, ½ to 1 inch in diameter, solitary and terminal or few in a simple or nearly simple umbel: involucres tomentose, 2 lines long: flowers glabrous, light rose-color, 1½ lines long. — Torr. & Gray, l. c. 166. *E. oblongifolium*, Benth.; Torr. & Gray, l. c. 167, the form with narrower and more cuneate leaves.

On the rocky sea-coast, from San Simeon Bay (*Palmer*) to Humboldt County.

32. **E. nudum**, Dougl. More slender, sparingly leafy at base, mostly glabrous above: leaves broadly ovate or oblong, obtuse, ½ to 2 inches long, cordate or abruptly cuneate at base, on slender petioles, undulate, densely tomentose beneath, becoming glabrate above: peduncle (fistulous and sometimes inflated) and sparingly branched panicle a foot or two high, smooth: involucres 2 or 3 lines long, glabrous or nearly so, usually 3 to 6 in each cluster: flowers glabrous or sometimes more or less villous, 1 to 1½ lines long, white or reddish, sometimes sulphur-yellow. — Torr. & Gray, l. c. 167. *E. nudum & auriculatum*, Benth. in DC. Prodr. xiv. 13.

Var. **pauciflorum**, Watson. Involucres solitary or occasionally in pairs, much scattered: peduncle often inflated. — Proc. Am. Acad. xii. 264.

Var. **oblongifolium**, Watson, l. c. Often somewhat tomentose throughout: leaves oblong, acute or obtuse, an inch or two long, narrowed to a long slender petiole: bracts occasionally foliaceous: perianth usually somewhat pubescent, at least on the inner lobes. — *E. affine*, Benth. l. c.

A very variable species, ranging from Washington Territory to Southern California, the last variety more common from Mendocino County and the Upper Sacramento northward.

33. **E. elatum**, Dougl. Leaves villous-pubescent or somewhat tomentose beneath, ovate-oblong to lanceolate, acute, 2 to 6 inches long and on elongated petioles, abruptly cuneate or rarely subcordate at base: peduncle (fistulous and sometimes inflated) and rigid panicle 1½ to 3 feet high, smooth and glaucous: involucres smooth, in clusters of 2 to 5, usually rather broadly turbinate and obscurely nerved, 2 lines long: flowers somewhat villous, greenish white or rose-colored, 1½ lines long. — Torr. & Gray, l. c. 168.

Dry mountain-slopes and valleys, from Washington Territory to Western Nevada; abundant on plains near Yreka, *E. L. Greene.*

+– +– *Stout woody perennials, the stems virgately branched and with numerous short-petioled often fascicled leaves: bracts mostly foliaceous: involucres capitate, or fascicled and the clusters more or less closely cymose-umbellate.* — (§ Fasciculata, Benth.)

34. **E. cinereum**, Benth. Shrubby, 3 to 5 feet high in dense clumps, hoary-tomentose throughout: leaves orbicular to oblong, 6 to 9 lines long, on very short petioles, obtuse, undulate, strongly nerved: peduncles elongated, sparingly dichotomous, bearing few rather open heads: bracts short: involucres 2 lines long: flowers very villous, rose-colored, 1½ lines long or less. — Bot. Sulph. 45 & DC. Prodr. xiv. 8; Torr. & Gray, l. c. 168.

On the sea-shore, Southern California, at San Pedro (*Hinds*) and Santa Monica, *Brewer.*

35. **E. parvifolium**, Smith. Shrubby, 3 feet high, more or less white-tomentose throughout: leaves broadly ovate to oblong, 4 to 9 lines long, acute, abruptly narrowed at base to a very short petiole, revolute and undulate on the margin, becoming glabrate above: peduncles usually rather short, bearing a few close heads: lower bracts conspicuous, the upper smaller: tomentose involucres and glabrous rose-colored flowers about 1½ lines long. — Benth. l. c. 12; Torr. & Gray, l. c. 169.

Near the sea coast from Monterey to Santa Barbara; Santa Lucia Mountains, *Palmer.*

36. **E. fasciculatum,** Benth. l. c. Shrubby, more or less tomentose and often somewhat villous: leaves narrowly oblanceolate, acute, nearly sessile, usually strongly revolute, tomentose beneath, often glabrate above, 3 to 9 lines long, much fascicled: peduncles short or elongated, bearing a short cymosely divided umbel often much contracted or capitate: bracts more or less conspicuous: involucres about 2 lines long, pubescent or glabrate: flowers rose-colored or whitish, glabrous or often more or less villous. — Torr. & Gray, l. c. *E. rosmarinifolium,* Nutt. Pl. Gambel. 164. *E. polifolium,* Benth. l. c. *E. ericæfolium,* Torr. & Gray, l. c. 170.

From the coast of Southern California (Santa Barbara and southward) east to Arizona and Southern Utah. Very variable in pubescence, etc., but the forms scarcely merit the rank of varieties. *E. polifolium* is a common hoary form with less revolute leaves and elongated peduncles. *E. ericæfolium* was founded upon very reduced specimens with short branches and small almost sessile heads; it occurs in Arizona and S. Utah.

+ + + *Perennials or annuals, leafy below: leaves not fascicled: bracts small, the lower very rarely foliaceous: involucres mostly solitary, in an open and repeatedly di- or trichotomous corymb-like cyme: perianth glabrous.* — (§ Corymbosa, Benth.)

++ *Perennial, woody and much branched, leafy below.*

37. **E. microthecum,** Nutt. Low and diffuse, rather slender, 3 to 12 inches high, more or less white-tomentose: leaves oblanceolate to linear, usually narrow, ½ to 1½ inches long, acute, more or less strongly revolute, white-tomentose beneath, becoming glabrate above, shortly petioled: peduncles short, bearing a short umbel of 3 to 5 more or less (once to thrice or more) subdivided rays: involucres usually small, ⅔ to 1½ lines long, attenuate at base and especially the alar ones often pedunculate: flowers a half to a line long, from nearly white to deep rose-color or rarely yellow. — Torr. & Gray, l. c. 170.

A very variable species, frequent in the mountains of the Great Basin and in the Rocky Mountains from Oregon and the eastern side of the Sierra Nevada to Nebraska and New Mexico. Reduced alpine forms are found at 8,000 to 10,000 feet altitude, Mono and Sonora Passes, and Silver Mountain, *Bolander, Brewer.* The var. *effusum,* Torr. & Gray (*E. effusum,* Nutt.), with more diffuse and repeatedly branched inflorescence is common in the Rocky Mountains but not westward.

38. **E. corymbosum,** Benth. Stouter and more rigid, usually densely tomentose: leaves usually longer and broader, ovate- to oblong-oblanceolate, and less revolute: umbel stiff, broadly cymose: involucres mostly sessile, a line or two long: flowers 1 or 2 lines long. — DC. Prodr. xiv. 17; Torr. & Gray, l. c. *E. microthecum,* var. (?) *Fendlerianum,* Benth. l. c.; Torr. & Gray, l. c.

In dry valleys and on the foothills from the base of the Sierra Nevada eastward. Forms occur apparently connecting this species with the last.

++ ++ *Annual: leaves mostly rosulate at the base, a whorl rarely subtending the nodes.*

39. **E. truncatum,** Torr. & Gray. A foot high, floccose-woolly throughout, slender: leaves oblanceolate, an inch long, attenuate to a slender petiole, less tomentose above, the margin undulate: peduncle short, bearing a leafy-bracted umbel of 4 to 6 elongated rays, which are loosely once or twice di- or trichotomous: bracts very small: involucres few, tomentose, oblong-turbinate, 2 lines long: flowers light rose-color, a line long. — Proc. Am. Acad. viii. 173.

On dry hillsides at Marsh's Ranch, east of Mount Diablo, *Brewer.* In flower, May 29.

40. **E. Mohavense,** Watson. A foot high or less, very slender, glabrous above the base, diffusely branched: leaves rounded or ovate, tomentose, half an inch long or less, abruptly narrowed to the slender petiole, all radical: peduncle short, bearing a naked umbel of 3 or more rays, repeatedly dichotomous with very slender joints:

bracts very small: involucres glabrous, broadly turbinate, a line long: flowers yellow, very small, scarcely a half line long, abruptly narrowed at base. — Proc. Am. Acad. xii. 266.

Collected in the valley of the Mohave River, *Palmer*, 1876.

41. **E. Lemmoni,** Watson, l. c. Rather stout, a span high, more or less hirsute with very short spreading hairs, not at all tomentose: leaves orbicular-reniform, 6 to 9 lines broad, on slender petioles, all radical: peduncles fistulous or inflated, short, bearing a naked 3-rayed narrow umbel twice or thrice dichotomous: bracts small: involucres glandular-pubescent, rather broadly turbinate, 1½ lines long: flowers pale rose-color, half a line long, with narrow lobes.

On sand-hills near Reno, Washoe County, Nevada, *J. G. Lemmon.* A very peculiar species, perhaps to be placed rather among the annuals of the following group though dissimilar in most of its characters.

+ + + + *Involucres sessile and solitary (often secund) along the ascending and usually long-virgate branches of the open naked dichotomous panicle: perennials or annuals, with small bracts or the lowest sometimes foliaceous: perianth glabrous, except in* n. 48. — (§ VIRGATA, Benth.)

++ *White-tomentose perennials with a woody branching base, leafy below: panicle sparingly branched, the branches more or less elongated and virgate: involucre tomentose, the teeth not margined.*

42. **E. Wrightii,** Torrey. Much branched and usually very leafy at base, a foot or two high, rather slender: leaves oblong- to linear-oblanceolate, ½ to 1 inch long, often with smaller ones fascicled in the axils, tomentose on both sides or less so above, acute, narrowed at base: bracts all small and triangular: involucres loosely spicate along the ascending branches, 1 to 1½ lines long; teeth rigid, acute: flowers rose-colored, 1 to 1½ lines long: akene scabrous on the angles above, very acute at base. — Torr. & Gray, l. c. 176. *E. Wrightii* & *trachygonum*, Torr.; Benth. in DC. Prodr. xiv. 14. *E. helianthemifolium*, Benth. l. c.

Var. **subscaposa,** Watson. The leafy branches very short.

A variable species ranging from the lower Sacramento (Corral Hollow, *Brewer*) to San Diego, and eastward to New Mexico; the variety in the Sierra Nevada and W. Nevada. At high altitudes the inflorescence is sometimes reduced to 2 or 3 involucres almost capitate upon a slender dwarfed scape; Mt. Pinos, at 8,500 feet altitude, *Rothrock.*

43. **E. saxatile,** Watson. Biennial or perennial (?), the densely leafy caudex sparingly branched, a half to a foot high, rather stout: leaves rounded or obovate, obtuse, 6 to 8 lines broad or less, cuneate at base, on a short thick petiole, densely tomentose both sides: branches of the cymose panicle short and somewhat spreading: bracts larger, subfoliaceous, triangular to acute-oblong: involucres 1½ to 2 lines long; teeth acute: flowers rose-colored, 2 lines long, the sepals appressed to the nearly glabrous akene, which is more abruptly narrowed at base. — Proc. Am. Acad. xii. 267.

On rocks above San Bernardino (*Parry*, 1876): in the Santa Lucia Mountains, *Palmer.*

44. **E. elongatum,** Benth. Stems erect and slender from a sparingly branched base, a foot or two high, often without branches: leaves usually somewhat scattered, oblong-lanceolate or sometimes nearly ovate, about an inch long, acute, narrowed to a short petiole, becoming glabrate above: bracts ovate-triangular to lanceolate, acute, rarely somewhat elongated: involucres 2½ to 3 lines long, obtusely toothed, distant on the few elongated branches: flowers white or rose-colored, 1 to 1½ lines long: ovary glabrous. — Bot. Sulph. 45 & DC. Prodr. xiv. 14; Torr. & Gray, l. c.

Near the coast from Monterey to San Diego.

E. STRICTUM, Benth. A very slender species, the leafy branches of the caudex very short, becoming glabrate above: leaves ovate to oblanceolate, ½ to 1 inch long, on long slender petioles,

greener above: panicle twice or thrice divided, with 1 to 3 involucres on the short branches: bracts short, the lower somewhat elongated: involucres glabrate, 1½ lines long, with acute triangular teeth: flowers light rose-color, 1½ lines long. — In the Blue Mountains, Oregon; collected only by *Douglas* and *Nervius*.

++ ++ *Perennials, woody and leafy at base, tomentose or glabrate: panicle diffuse, with short rigid branchlets: involucre short, the teeth rounded and more or less membranous-margined.*

45. **E. Heermanni**, Dur. & Hilg. Shrubby at base, a foot high, yellowish, soon glabrate above, divaricately dichotomous, the short rigid branchlets somewhat spinescent: leaves scattered at the base, oblanceolate, half an inch long, on slender petioles; bracts very small, triangular: involucres few and distant, campanulate, a line long, the teeth rounded and margined, glabrous: flowers 1½ lines long, rose-colored or yellowish, the outer lobes obovate, the inner narrower. — Pacif. R. Rep. v. 14, t. 17; Torr. & Gray, l. c. 179.

In dry valleys of California and Nevada; on Pose Creek (*Heermann*); Washoe and Humboldt Counties, Nevada (*Torrey, Lemmon*); S. Nevada, *Wheeler*.

46. **E. Palmeri**, Watson. More tomentose throughout, and usually taller, with a short branching leafy base: leaves lanceolate or oblanceolate, acute, half an inch long, on short petioles: stems somewhat flexuous, mostly alternately branched, the short branchlets divaricate or deflexed, very short-jointed: bracts very small: involucres rather numerous, narrowly turbinate, a line long, nearly glabrous, the rounded teeth pubescent: flowers a line long, white tinged with rose-color, the outer lobes cuneate-obovate, the inner slightly narrower: akene somewhat pubescent. — Proc. Am. Acad. xii. 267.

Collected only by *Dr. E. Palmer* at Julian and San Felipe, San Diego County, and also in Southern Utah.

++ ++ ++ *Annuals: leaves rosulate at the base, but sometimes also occurring at the nodes. Species mostly of difficult definition.*

= *Tomentose throughout: branches virgate, sparingly divided: involucres narrow, 2 lines long.*

47. **E. virgatum**, Benth. Slender, a foot or two high or more: leaves oblanceolate, an inch or two long, on slender petioles, the margin usually undulate: branches elongated and ascending, strictly virgate or flexuose: bracts lanceolate, shorter than the involucres, sometimes including one or more leaves: involucres tomentose, 2 lines long: flowers a line long, rose-colored to white or yellow, glabrous. — DC. Prodr. xiv. 16; Torr. & Gray, l. c. 177. *E. roseum*, Dur. & Hilg. in Pacif. R. Rep. v. 14, t. 15; the exceptional more foliaceous and branching form.

From Siskiyou County (*Greene*) to Los Angeles, in the Coast Ranges, and also in the Sierra Nevada as high as the Yosemite Valley. As respects tomentum it appears to be variable, ranging towards *E. vimineum*, from which it should be distinguished by the narrower leaves, larger involucres, and less diffuse habit.

48. **E. dasyanthemum**, Torr. & Gray, l. c. Less tall and more slender: leaves rounded, half an inch broad or less, somewhat scattered upon the stem: panicle more branched and rather diffuse: bracts very small: involucres scarcely 2 lines long, very narrow, flowers a line long or less, villous at least at base.

Near Clear Lake (*Bolander, Torrey*); Borax Lake (*Torrey*); also near Virginia City, *Bloomer*.

= = *Glabrous or somewhat tomentose, slender and more diffusely branched: involucres* 1 *to* 1½ *lines long, narrow or turbinate: bracts very small.*

49. **E. vimineum**, Dougl. Rather diffuse, the branches often elongated, a half to a foot high, usually more or less tomentose at least below the panicle: leaves orbicular to broadly ovate, 3 to 10 lines broad, undulate, less tomentose above; the

petioles about as long: involucres narrow and often somewhat contracted above, about 1½ lines long: flowers light rose-color or sometimes yellowish, a line long or more. — Benth. l. c. 17; Torr. & Gray, l. c.

From Washington Territory to San Diego County and N. W. Nevada; frequent and variable.

50. **E. Baileyi,** Watson. Very diffusely much-branched, a foot high or less, glaucous and glabrous (rarely somewhat tomentose throughout) excepting the leaves, which are densely white-tomentose both sides, orbicular to broadly ovate, 3 to 6 lines broad: bracts short, triangular or lanceolate: involucres a line long or usually less, mostly somewhat wider above, with obtuse teeth: flowers light rose-color or yellowish, very small (½ to ¾ line long). — Proc. Am. Acad. x. 348. *E. gracile,* var. *effusum,* Torr. & Gray, l. c. 178, in part.

Var. (*l*) **tomentosum,** Watson. Loosely floccose-tomentose throughout: bracts more linear: involucres broadly turbinate and deeply toothed. — Proc. Am. Acad. xii. 268.

Eastward of the Sierra Nevada in the valleys and on the foothills, from Northwestern Nevada to Arizona and San Bernardino and Kern Counties, and across the boundary in Lower California (*Palmer*); the variety in San Bernardino County (*Lemmon*) and Tantillas Mountains, *Palmer.*

51. **E. gracile,** Benth. Usually somewhat strict and narrowly panicled, more or less floccose-tomentose throughout, a foot high: leaves oblanceolate, or sometimes oblong, an inch long or less, attenuate to a slender petiole, tomentose both sides or less so above: bracts more or less elongated or somewhat foliaceous, the lower often including one or more leaves: involucres scarcely a line long, broader above, with rigid acute teeth, often dark brown: flowers rose-colored or yellowish, ¾ line long. — Bot. Sulph. 46, & DC. Prodr. xiv. 17; Torr. & Gray, l. c. 178.

Southern California in the Coast Ranges, from Monterey or perhaps San Francisco to San Diego. Variable in habit and pubescence; sometimes spreading and diffuse, with glabrate involucres and larger flowers (var. *effusum,* Torr. & Gray, l. c.), or densely white-woolly and with strict narrow panicle, either with naked stem and light-colored flowers (var. *leucocladon,* Torr. & Gray; *E. leucocladon,* Benth.), or the stem leafy and flowers reddish (var. *acctoscelloides,* Torr. & Gray; *E. acctoscelloides,* Torr.).

E. POLYCLADON, Benth., of Arizona and New Mexico, is a similar stout white-woolly species, the stem leafy its whole length, and the panicle erect and elongated: leaves oblong-oblanceolate, an inch long or less: bracteoles much more villous than in the preceding species.

52. **E. Plumatella,** Dur. & Hilg. Slender, 3 to 8 inches high, diffusely and intricately much-branched from the base, grayish tomentose throughout, the whole plant often reddish: leaves orbicular, 2 to 6 lines broad, on slender petioles: involucres very short, half a line long or less, scarcely exceeding the short bracts: flowers yellow, rose-colored, or white, ¾ to at length 1½ lines long, the segments slightly unequal, broadly obovate-cuneiform and retuse. — Pacif. R. Rep. v. 14, t. 16; Torr. & Gray, l. c. 179.

Frequent in the dry valleys of Northwestern Nevada; on Pose Creek, *Heermann.*

E. INTRICATUM, Benth. Bot. Sulph. 46, t. 22, is the only other species of this group, from San Bartolome, Lower California. The diffuse panicle is glabrous or glabrate, with numerous short divaricate branchlets; involucres very small and glabrous; flowers also minute, sparingly hairy: leaves rounded, on long petioles, viscid-pubescent.

6. OXYTHECA, Nutt.

Involucres few-flowered, more or less pedicellate, campanulate or turbinate, herbaceous and not reticulated, 3–5-cleft, the erect or spreading lobes mostly terminated by straight slender awns. Flowers (6-parted), bracteoles, etc., as in *Eriogonum.* Akene ovate-lenticular (where known); the elongated radicle accumbent upon the rounded cotyledons. — Slender diffusely branched (repeatedly dichotomous) annuals, the slender internodes more or less covered with small stipitate glands: leaves

rosulate at the base; bracts ternate, foliaceous and more or less connate, often awned: segments of the glandular-pubescent perianth similar and equal: ovary glabrous. Only the following species. — Torr. & Gray, Revis. Eriog. in Proc. Am. Acad. viii. 190.

* *Bracts united only at base.*

1. **O. inermis**, Watson. Low and slender: leaves broadly oblanceolate, an inch long, glabrous, with scabrous-ciliate margin: bracts linear-oblong, acute without awns, 2 or 3 lines long: involucres shortly pedicelled, 4-cleft nearly to the base, the oblong-lanceolate lobes nearly equal, acute without awns, a line long: flowers rose-colored, half a line long; segments oblong, the inner smaller and retuse. — Proc. Am. Acad. xii. 273.

Collected only by *Miss M. J. Bancroft*, probably on Mount Diablo; remarkable for the total absence of awns.

2. **O. dendroidea**, Nutt. Very slender, diffuse and much branched, a foot high or less, or stouter and less divided; the scape-like stem usually 1 or 2 inches high: leaves linear-oblanceolate, hirsute, ½ to 1½ inches long, acute: bracts unequal, without awns, linear-oblong to linear, or oblong ovate in the stouter form, the lower half an inch long or less, the upper much smaller: involucres turbinate, ½ to 1½ lines long (excluding the short awns), unequally 3 – 4-lobed, rather fleshy, those in the forks on slender pedicels 1 to 4 lines long, the rest more nearly sessile: flowers light rose-color, half a line long; outer segments obovate, the inner narrower and shorter. — Pl. Gambel. 169; Benth. in DC. Prodr. xiv. 23; Torr. & Gray, l. c. *O. apiculata*, Miers, Linn. Trans. xxi. 144, t. 17. *Brisegnoa Chilensis*, Gay, Fl. Chil. v. 292, t. 58.

In dry cañons from Northwestern Nevada (*Torrey, Watson*) to Northwestern Wyoming, (*Nuttall, Parry*); also in Chili, the slender form with very numerous branches and many-flowered, the involucres small.

3. **O. Watsoni**, Torr. & Gray, l. c. A span high or less, glaucous: leaves oblanceolate, an inch long, glandular-pubescent: bracts apparently in pairs (one very small or wanting), ovate to oblong-lanceolate, connate on one side and reflexed, awned, half an inch long or less: involucres turbinate, 4-lobed, half a line long, the awns elongated, very shortly pedicelled, about 3-flowered: flowers a third of a line long, white; segments oblong, entire. — Watson, Bot. King Exp. 311, t. 33, f. 5 – 7.

Valleys of Northern Nevada, *Watson.*

4. **O. trilobata**, Gray. Resembling the last in habit, not glaucous: leaves somewhat villous: bracts ternate, oblong-lanceolate, awned, not reflexed: involucres broadly turbinate, 5-parted nearly to the base, strongly nerved, 1½ to 2 lines long, with awns shorter than the lobes, on spreading pedicels 2 to 5 lines long, 3 – 4-flowered: flowers light rose-color, a line long; segments ligulate-oblong, 3-cleft, the lanceolate lobes acuminate, slightly erose on the sides: ovary triangular. — Proc. Am. Acad. xii. 83.

San Bernardino County, *Parry & Lemmon*, 1876.

* * *Bracts united into a rounded concave perfoliate disk.*

5. **O. perfoliata**, Torr. & Gray, l. c. Diffuse, a span high or less, glaucous, often reddish: leaves spatulate, ciliate, an inch long or less: lowermost bracts 3 or 4, small, united only at base, the rest large and conspicuous, perfoliate and 3-awned, net-veined: involucres nearly sessile in the forks, more narrowly turbinate, deeply 5-cleft or -parted, 1 to 1½ lines long, with long awns, 4 – 6-flowered: flowers white, nearly a line long. — Watson, Bot. King Exp. 311, t. 34, f. 1 – 3.

In dry valleys of Northwestern Nevada (*Watson, Lemmon*); on the Mohave River (*Palmer*); S. Utah, *Parry.*

7. CHORIZANTHE, R. Brown.

Involucres 1 – 3-flowered, sessile, tubular, coriaceous or chartaceous, more or less reticulated or corrugated, 3 – 6-angled or -costate and 3 – 6-toothed or -cleft, the teeth cuspidate or rigidly awned. Flowers pedicellate or nearly sessile, included in the involucre or rarely exserted, 6-parted or -cleft. Stamens 9, rarely 3 or 6. Bractlets minute or usually obsolete. Ovary glabrous and akene triangular. In other respects as *Eriogonum*. — Low dichotomously branched annuals (the Chilian species mostly perennial), with usually rosulate radical leaves, and ternate bracts. — Torr. & Gray, in Proc. Am. Acad. viii. 192. Watson, Proc. Am. Acad. xii. 269. *Chorizanthe* & *Mucronea*, Benth. *Acanthogonum*, Torr. *Centrostegia*, Gray.

The species, as in *Eriogonum*, vary much in habit and other characters, and are grouped into several sections which have been regarded as genera. *Centrostegia* is here also included, as too closely connected with *Mucronea* to be separated from it. Besides the following, nine species are found in Chili, perennials with a single exception. The characters are not always obvious, and it will be noticed that several species are known from only a single locality or collector.

Glabrous or glandular, not villous nor tomentose : bracts foliaceous, connate : flowers 6-parted, soft-pubescent : stamens 9, at the base.
- Involucres 1 – 3-flowered, spurred at base : bracts small.
  - Spurs 3, broad, straight : teeth short and broad. — 1. C. THURBERI.
  - Spurs 4 to 6, awn-like, hooked : teeth narrow, attenuate. — 2. C. LEPTOCERAS.
- Involucres 1-flowered, not spurred : bracts conspicuous.
  - Sparingly hirsute : bracts perfoliate : perianth-segments laciniate. — 3. C. PERFOLIATA.
  - More hirsute : bracts unilateral : segments entire. — 4. C. CALIFORNICA.

Villous-pubescent or hirsute, not glandular : bracts not connate : involucres 1-flowered, 6-toothed : flowers 6-cleft (6-parted in n. 5) : stamens mostly 9, inserted below the middle.
- Involucres capitate-glomerate ; teeth mostly more or less scarious-margined : stems usually leafy and bracts foliaceous.
  - Teeth united by a scarious petaloid margin : erect : heads few.
    - Floccose-tomentose, slender, leafy : leaves linear : margin broadly dilated : flowers pedicelled, pubescent : lobes spatulate. — 5. C. MEMBRANACEA.
    - Hirsute : leaves oblanceolate : margin narrower : flowers glabrous, sessile, 2½ lines long : lobes obcordate : leaves scattered. — 6. C. STELLULATA.
    - Nearly sessile, a line long ; lobes truncate, the outer cuspidate, inner retuse : leaves in 1 or 2 whorls. — 7. C. DOUGLASII.
  - Teeth distinct : usually more diffuse and decumbent, villous-pubescent : heads more numerous.
    - Decumbent, slender : involucres and flowers 1 to 1½ lines long.
      - Leaves narrow : bracts acerose : teeth long-awned, scarious : flowers a line long. — 8. C. DIFFUSA.
      - Leaves ovate : bracts foliaceous : teeth short, the sinus scarious : flowers 1½ lines long. — 9. C. BREWERI.
      - Leaves oblanceolate : bracts foliaceous : teeth scarious : flowers 1½ lines long : lobes equal. — 10. C. PUNGENS.
    - Stout, erect : bracts foliaceous : involucres and flowers 2 to 2½ lines long.
      - Teeth equal, straight : perianth-lobes oblong, entire. — 11. C. VALIDA.
      - One tooth long-awned ; margin none : lobes broad, the shorter retuse, laciniate. — 12. C. PALMERI.

Involucres in looser cymes or scattered, not scariously margined : leaves all radical.
- Perianth-lobes lanceolate, fringed : bracts not foliaceous.
  - Lobes coarsely fringed below the obtuse summit. — 13. C. FIMBRIATA.
  - Lobes finely fringed, long-acuminate. — 14. C. LACINIATA.
- Perianth-lobes oblong, entire.
  - Bracts not foliaceous.
    - Leaves oblong, tomentose beneath : flowers pinkish, 2 lines long : lobes oblong, unequal. — 15. C. STATICOIDES.
    - Leaves spatulate, not tomentose : flowers yellow, 1½ lines long : lobes equal, narrow. — 16. C. PROCUMBENS.

Bracts more or less foliaceous: flowers 1½ lines long or more.
Leaves narrow, not tomentose: teeth long-divergent: lobes undulate, unequal, oblong-ovate, acutish. 17. C. PARRYI.
Leaves and bracts ovate-oblong, small, tomentose beneath: involucres tomentose, in diffuse cymes: flowers 2½ lines long; lobes narrow, very unequal: stamens often 6. 18. C. XANTI.
Leaves and oblanceolate bracts tomentose beneath: involucres more glabrous, in small cymes; teeth short: flowers 1½ lines long; lobes broadly oblong: stamens 6. 19. C. WHEELERI.
Villous-pubescent: one tooth long-awned: flowers yellow, unequally cleft: stamens 3 or 9. 20. C. UNIARISTATA.
Puberulent, thick-jointed: involucres narrow; teeth very short: lobes narrow, nearly equal: stamens 3 or 6. 21. C. BREVICORNU.
Villous-pubescent: bracts distinct: involucres 3–5-toothed, 1-flowered: flowers 6-cleft: stamens 6 or 9, on the throat.
Involucres broadly triangular: bracts foliaceous.
Leaves and bracts narrow; floral bracts very short: teeth broad. 22. C. POLYGONOIDES.
Leaves and bracts ovate, tomentose beneath: floral bracts elongated, stout, rigid and persistent: teeth 3, lanceolate. 23. C. RIGIDA.
Involucres narrowly cylindrical: bracts not foliaceous.
Leaves ovate: involucres strongly corrugated, 3-toothed. 24. C. CORRUGATA.
Leaves narrow: involucres obscurely corrugated, 5-toothed. 25. C. WATSONI.

§ 1. *Involucres coriaceo-chartaceous, the awns of the erect or divergent teeth not uncinate: flowers on slender pedicels, included or more or less exserted, white or pinkish: perianth 6-parted, pubescent with soft hairs, the 9 stamens inserted upon the base: bractlets minute. Glabrous or glandular, never villous-tomentose: bracts ternate, foliaceous, more or less connate and unilateral: leaves all radical and spatulate: involucres axillary and terminal in open dichotomous panicles.* — MUCRONEA.

* *Involucres 1–3-flowered, with 3 to 6 mostly erect teeth, and with 3 to 6 divaricate cuspidate or awned spurs at base: bracts small.* — (*Centrostegia*, Gray.)

1. **C. Thurberi**, Watson. More or less glandular-puberulent, 6 inches high or usually less, branching from near the base: leaves an inch long, glabrous, slightly ciliate: bracts oblong, more or less united, 1 to 3 lines long: involucres glabrous, chartaceous, triangular-prismatic, obscurely reticulated, 2 or 3 lines long and ½ to 1 line broad, with 3 broad straight-awned spurs at base, and with 3 to 5 broad and short erect teeth: flowers 1 or 2, rarely exserted, nearly a line long, pubescent at base: segments oblong-spatulate, obtuse or emarginate, the alternate ones slightly shorter. — Proc. Am. Acad. xii. 269. *Centrostegia Thurberi*, Gray; Benth. in DC. Prodr. xiv. 27; Torr. & Gray, l. c. 192.

In the desert region of S. California and eastward, from Fort Tejon (*Rothrock*), San Bernardino (*Parry*) and San Felipe (*Thurber*) to Southern Utah.

2. **C. leptoceras**, Watson, l. c. Very slender, nearly glabrous: leaves and bracts as in the last: involucres 2 or 3 lines long, somewhat hirsute, deeply 4–6-cleft, the coriaceous turbinate base surrounded by as many rigid usually uncinate awn-like spurs; lobes rigid, narrow, unequal, attenuate into straight rigid somewhat divergent awns: flowers 2 or 3, occasionally exserted, villous-pubescent, half a line long: segments narrowly oblong to ovate, nearly equal. — *Centrostegia leptoceras*, Gray; Torr. & Gray, l. c.

Plains of San Gabriel (*Lobb*); near San Bernardino, not rare, *Parry*.

* * *Involucres 1-flowered, with 2 to 5 unequal stout divergent teeth, not spurred at base: bracts conspicuous.* — (§ *Mucronea*, Torr. & Gray.)

3. **C. perfoliata**, Gray. Sparingly hirsute and glandular, a foot high or less, often bright red: leaves an inch or two long: bracts connate about the stem, forming a somewhat unilateral triangular reticulated disk, the lower often an inch broad:

involucres scattered on the slender branches, 1½ to 3 lines long, strongly angled and sulcate, becoming corrugated, mostly 4-toothed: flowers a line long, pubescent, the equal oblong perianth-segments laciniately fringed. — Torr. & Gray, l. c. 197.

On dry hills in the Coast Ranges, from Stanislaus County (*Brewer*) southward; Fort Tejon (*Xantus*); on the Mohave River, *Palmer*.

4. **C. Californica,** Gray. Resembling the last, but somewhat more hirsute: bracts more lateral, rarely perfoliate, and the disk more deeply lobed: involucres on contracted branchlets and often clustered in the axils, more obtusely angled and not sulcate, usually 2 – 3-toothed and 2 – 3-sided: segments of perianth obovate, entire. — Torr. & Gray, l. c. *Mucronea Californica*, Benth. Linn. Trans. xvii. 419, t. 20.

In the Coast Ranges from San Luis Obispo to San Diego.

§ 2. *Involucres coriaceous, 1-flowered, 6-angled and -sulcate, the unequal divergent teeth terminating in stout cusps or awns, mostly uncinate: flowers nearly sessile, included or only partially exserted, 6-cleft (rarely 6-parted), glabrous or bristly-villous on the midveins (rarely pubescent): stamens 9 (rarely 3 or 6), mostly adnate to the tube near the base or below the middle: bractlets obsolete. More or less villous-pubescent or hirsute, not glandular, fragile: bracts 1 to 3, distinct, often foliaceous, at least the uppermost acicular-subulate: involucres usually more or less clustered or capitate.* — EUCHORIZANTHE, Torr. & Gray.

* *Involucres in close cymes (heads); margins of the teeth often scarious: stems more or less leafy and the bracts mainly foliaceous.*

+ *Margin of the involucre becoming wholly scarious and petaloid between the awns (those in the forks marginless): stem erect and heads dense.*

5. **C. membranacea,** Benth. Slender, floccose-tomentose, leafy, ½ to 2 feet high, sparingly branched above, the branches ascending: leaves linear, scattered along the stem, an inch or two long, acute: bracts mostly similar, cuspidate: heads sessile, solitary or few upon the branches: involucres tomentose, 2 to 2½ lines long, with at length a broad dilated limb and equal uncinate teeth, the triangular tube contracted in the middle: flowers villous, ½ becoming 1½ lines long, 6-parted: segments spatulate, the inner narrower and slightly shorter: stamens at the base: pedicel equalling the flower. — Linn. Trans. l. c., t. 17, f. 11; Torr. & Gray, l. c. 193.

Central California, from Mendocino County to San Luis Obispo. The flower in this species is that of the preceding section.

6. **C. stellulata,** Benth. Hirsutely pubescent, 3 to 6 inches high, umbellately branched above: leaves linear-oblanceolate, scattered or the upper ones opposite, an inch long or less: heads few and terminal; the upper bracts broadly acerose and coarsely hirsute: involucres 2 or 3 lines long, strongly 6-costate becoming triangular, equally toothed, the margin not broadly dilated: flowers sessile, glabrous, equalling the involucre, tubular, equally 6-cleft: the segments obcordately 2-lobed: stamens adnate near the base. — Pl. Hartw. 333, & DC. l. c.; Torr. & Gray, l. c.

Known only from *Hartweg's* specimens, collected in the "valley of the Sacramento."

7. **C. Douglasii,** Benth. Resembling the last, but the leaves verticillate in one or two whorls upon the stem: bracts setaceous, villous, purplish: involucres 1½ lines long, somewhat unequally toothed: flowers distinctly pedicelled, glabrous, a line long, not cleft to the middle: the broadly cuneate-oblong segments truncate, the outer cuspidate, the inner shorter and retuse: stamens adnate near the base. — DC. Prodr. xiv. 25; Torr. & Gray, l. c.

Collected only by *Douglas*. Specimens from Santa Margarita Valley (501 & 893 *Brewer*), referred here by Torr. & Gray, l. c., are probably distinct, being more slender and more softly pubescent, and the stem naked excepting the 3 leafy bracts subtending 3 slender rays; flowers sessile, bristly-villous on the midveins, the longer segments scarcely mucronate.

+ + *Teeth of the involucre scariously margined or wholly herbaceous: more diffuse and decumbent or ascending, with more numerous scattered heads, rarely erect.*

8. **C. diffusa**, Benth. Very slender, villous-pubescent, the stems at length decumbent and 6 inches long, sparingly branched: leaves narrowly spatulate, mostly radical, an inch long or less: bracts short and acerose: heads small and rather loose: involucres a line long, unequally toothed, the longer teeth equalling the tube, the alternate ones shorter, mostly broadly scarious on the margin and long-awned, uncinate: flowers a line long, glabrous, very shortly pedicelled, shortly 6-cleft: segments oblong, nearly equal, obtuse, the inner a little narrower: filaments inserted near the base; anthers oval. — Pl. Hartw. 333, & DC. l. c.; Torr. & Gray, l. c.

Near Monterey, on the dry sandy plain (*Hartweg*) and on the seashore, *Parry.*

9. **C. Breweri**, Watson. Slender, softly pubescent, ascending or erect, 2 to 4 inches high: leaves ovate or rounded, 3 to 6 lines broad, on slender petioles: bracts foliaceous, linear-oblanceolate, pungent: heads small: involucres 1½ lines long, the short slightly unequal teeth united at base by an inconspicuous margin, stout and curved, shortly awned: flowers 1½ lines long, glabrous or villous: segments broadly oblong, the inner ones shorter: stamens at the base. — Proc. Am. Acad. xii. 270.

On rocky hillsides at San Luis Obispo, and in sandy soil in Santa Margarita Valley, *Brewer.*

10. **C. pungens**, Benth. Usually slender and more or less decumbent or at first erect, villous-pubescent; stems often a foot long or more, leafy: leaves spatulate or oblanceolate, about an inch long, mostly opposite: bracts similar, narrower, awned at the apex: heads small: involucres 1½ to 2 lines long, unequally toothed (the alternate teeth smaller), usually margined; teeth strongly uncinate: flowers very shortly pedicelled, narrowed at base, 1½ lines long, glabrous or often villous on the nerves, shortly cleft: segments equal, oblong, entire: filaments more or less adnate to the lower part of the tube. — Linn. Trans. xvii. 419, t. 19, f. 2, & DC. l. c.; Torr. & Gray, l. c. 194.

Very common in sandy plains near San Francisco, to Monterey and probably southward.

11. **C. valida**, Watson. Mostly stout, erect, six inches high or less, villous-pubescent, sparingly branched: leaves oblanceolate, an inch long; the bracts similar: involucres in rather crowded heads, 2½ to 3 lines long, nearly equally toothed; teeth slightly spreading, with straight awns, scarcely margined: flowers nearly sessile, narrowly tubular, 2½ lines long, villous or glabrous, cleft a third of the way down; segments oblong, very unequal, the shorter ones erose: filaments adnate to the middle or nearly to the summit. — Proc. Am. Acad. xii. 271.

Sonoma County; specimens in herb. Gray are from the Russian Colony (from herb. St. Petersb. Acad.), and also collected by *Samuels*, probably in the same region.

12. **C. Palmeri**, Watson, l. c. Stout, erect and branching, villous-pubescent, a span high or less: leaves spatulate, 2 inches long: bracts oblanceolate, conspicuous: involucres in large close terminal cymes, 2 lines long; the teeth not at all margined and slightly divergent, one long-awned, the rest nearly equal: flowers rose-colored, 2 lines long, nearly sessile, glabrous, broadly lobed above: outer segments orbicular, the inner shorter, truncate or bifid, shortly laciniate: stamens near the base.

Near San Luis Obispo, *Palmer* (n. 464), 1876.

* * *Involucres at length scattered or only loosely cymosely clustered; teeth unequal, not scariously margined.*

+ *Perianth deeply cleft, the lanceolate segments fimbriate: leaves all radical: bracts not foliaceous.*

13. **C. fimbriata**, Nutt. Somewhat villous-pubescent or glabrate; stem erect or branching from the base, becoming diffusely much branched, 6 inches high or

less, usually purplish: leaves an inch or two long, spatulate or oblong-ovate and petiolate, mucronate: bracts linear-setaceous, rather conspicuous: involucres 2 or 3 lines long, or more, with very unequal teeth, the alternate ones often much enlarged and widely spreading: flowers sessile, glabrous: perianth-segments exserted, obtuse at the apex, coarsely fringed below. — Pl. Gambel. 168; Torrey, Pacif. R. Rep. v. 364, t. 8; Torr. & Gray, l. c.

Frequent on dry hills from Santa Barbara to San Diego, and east to the Mohave River.

14. **C. laciniata,** Torrey. Very similar to the last: involucres 1½ to 2 lines long, the teeth less enlarged: segments of the perianth long-acuminate and copiously fringed. — Pacif. R. Rep. vii. 19; Torr. & Gray, l. c.

At San Felipe, *Antisell.*

+– +– *Short segments of the perianth oblong, entire.*

++ *Bracts not foliaceous.*

15. **C. staticoides,** Benth. Erect or procumbent, rather stout, often a foot high or more, with spreading branches, villous-pubescent, often purplish: leaves all radical, tomentose beneath, oblong, obtuse, 1 to 2½ inches long including the petiole: bracts all acerose: involucres in rather close cymes, 1½ to 3 lines long, the alternate teeth larger and nearly equal, often much enlarged: flowers nearly sessile, 2 to 2½ lines long, glabrous, cleft a third of the way down: segments rather narrowly oblong, entire, the alternate ones nearly half shorter and usually narrower: stamens at base. — Linn. Trans. xvii. 418; Torr. & Gray, l. c.

From Monterey to San Diego.

16. **C. procumbens,** Nutt. Slender and procumbent, branching from the base and very diffuse, villous-pubescent, and often yellowish: leaves spatulate, an inch long or more, not tomentose: bracts mostly small: involucres 1 to 1½ lines long, the alternate teeth strongly divergent and about equalling the tube, uncinate: flowers yellowish, sessile, 1¼ lines long, glabrous or somewhat villous: segments equal, narrowly oblong, obtuse and entire: stamens at the base. — Pl. Gambel. 167; Torr. & Gray, l. c.

Collected only about San Diego.

++ ++ *Bracts more or less foliaceous.*

17. **C. Parryi,** Watson, l. c. Small (2 or 3 inches high), branching from the base, villous-pubescent, leafy: leaves narrowly oblanceolate, an inch long, not tomentose: lower bracts as large, similar, pungent: tube of the involucres a line long, the very divergent alternate teeth as long or longer: flowers nearly sessile, white or pinkish, 1½ lines long, villous on the nerves, cleft nearly to the middle: segments recurved and somewhat undulate, oblong-ovate, crenate, acutish; the inner ones narrower and scarcely shorter: stamens at the base.

Common on gravelly mesas near Crofton, San Bernardino County, *Parry,* 1876.

18. **C. Xanti,** Watson. Small (2 to 4 inches high), branching diffusely from near the base, villous-pubescent and tomentose: leaves ovate-oblong, 2 to 6 lines long, on slender petioles, tomentose beneath: the lower bracts similar or linear-oblanceolate: involucres tomentose, in diffuse cymes, the tube 2 lines long, with very divergent teeth often half as long or more, the alternate ones much smaller: flowers rose-colored, 2½ lines long, sessile, villous: segments linear-oblong, entire, acutish, the alternate ones a half shorter: stamens 6 (rarely 7 or 8), at the base. — Proc. Am. Acad. xii. 272. *C. procumbens,* Gray, Proc. Bost. Soc. Nat. Hist. vii. 148; referred to *C. staticoides* in Torr. & Gray, Revis. 195.

Southern California, near Fort Tejon (*Xantus, Horn*); San Bernardino and San Gorgonio, on sandy washes, *Parry.*

19. **C. Wheeleri,** Watson, l. c. Low with spreading branches, 3 or 4 inches high, villous-pubescent and tomentose: leaves and bracts tomentose beneath; the latter oblanceolate, an inch long or less: involucres in small terminal cymes, nearly glabrous, a line long, with short stout teeth, the alternate ones smaller: flowers rose-colored, 1½ lines long, sessile, glabrous, cleft a third of the way down: segments broadly oblong, the alternate ones slightly shorter and broader: stamens 6, near the base.

Near Santa Barbara, *Dr. J. T. Rothrock*, on U. S. Geog. Survey under Lieut. G. M. Wheeler.

20. **C. uniaristata,** Torr. & Gray, l. c. Procumbent or ascending, villous-pubescent, diffusely branching from the base: leaves and bracts spatulate or oblanceolate, an inch or two long, the latter diminishing upward and pungent: involucres numerous, scattered, the tube 1 to 1½ lines long; one tooth with a long straight awn, the rest short and uncinate: flowers nearly sessile, yellowish, glabrous or slightly villous, 1½ lines long, shortly cleft: segments very unequal, the outer obovate, entire, the inner oblong, crenate: stamens 3 or 9, at the base.

At New Idria (*Brewer*), and at McGinnis' on the headwaters of the Salinas, *Palmer*.

21. **C. brevicornu,** Torrey. Pulverulent or nearly glabrous, branching from the base, erect or ascending, 6 inches high or less, very fragile at the enlarged nodes: leaves broadly spatulate to linear-oblanceolate, an inch or two long: bracts similar, acute or pungent: involucres scattered, narrow, triangular, 1½ to 2 lines long; teeth very short and hooked, the alternate ones smaller: flowers included, sessile, glabrous, shortly cleft: segments narrowly oblong, nearly equal: stamens 3 or 6, at the base. — Bot. Mex. Bound. 177; Torr. & Gray, l. c. 196; Watson, Bot. King Exp. 312.

N. W. Nevada to the Colorado Valley, Arizona and S. Utah. No well-developed flowers seen.

§ 3. *Involucres coriaceous, 1-flowered, triangular or cylindrical, 3–5-toothed or -lobed; teeth unequal, with straight or curved awns; tube transversely corrugated: flowers included or nearly so, tubular, shortly 6-cleft, glabrous: stamens 6 or 9, with short filaments inserted on the throat. Low, branching and fruiting from the base, villous-pubescent and tomentose: bracts 2 or 3, distinct: involucres scattered.* — ACANTHOGONUM, Torr. & Gray. (*Acanthogonum*, Torr.)

* *Involucres broadly triangular: bracts foliaceous.*

22. **C. polygonoides,** Torr. & Gray, l. c. Decumbent, villous-pubescent: stems 1 to 3 inches long: leaves and bracts narrowly oblanceolate, an inch long or less, acute; floral bracts very short: involucres rather crowded on the short branches, broadly triangular-turbinate, 3-costate, with 3 stout and broad divergent uncinate teeth longer than the (1 line long) tube; the intermediate teeth very small: flowers nearly sessile, slightly exserted: segments oblong, equal: stamens 6 or 9; filaments very short.

Collected only on Reservoir Hill, Placerville, by *Rattan*.

23. **C. rigida,** Torr. & Gray, l. c. Erect, 1 to 4 inches high, villous-pubescent, very shortly branched, usually dense with the conspicuously bracted involucres, the whole plant becoming rigid and persistent: leaves ovate, 3 to 12 lines in diameter, on long petioles, tomentose beneath: bracts similar, obtuse or apiculate; floral bracts linear-subulate, stout and spinescent, 6 to 15 lines long: involucres with a broad-triangular 6-costate tomentose tube, a line long; teeth 3, unequal, lanceolate and carinate, spinescent or pungent, 2 to 9 lines long: flowers yellowish, nearly sessile, equalling the tube: segments oblong, equal, somewhat villous: stamens 9. — Watson, Bot. King Exp. 312.

From Northwestern Nevada to the Colorado Valley, Arizona and Southern Utah.

* * *Involucres cylindrical: bracts not foliaceous.*

24. **C. corrugata**, Torr. & Gray, l. c. Somewhat villous-pubescent and tomentose, much branched from the base and ascending, 2 to 4 inches high: leaves ovate, tomentose beneath, half an inch long, on slender petioles: bracts subulate-setaceous, small: involucres numerous, the tube 1 or 2 lines long, narrow and attenuate at base, scarcely angled, strongly corrugated, bearing 3 foliaceous ovate-lanceolate short-awned and uncinate lobes, somewhat tomentose above and rather longer than the tube: flowers white, included, less than a line long and about equalling the pedicel: segments oblong, equal, villous above: stamens 6 or 9 on the middle of the tube.

Near Fort Yuma (*Gen. Thomas*) and northward in the Colorado Valley, *Palmer*.

25. **C. Watsoni**, Torr. & Gray, l. c. Villous-pubescent and somewhat tomentose, with spreading or procumbent branches, 2 to 4 inches long: leaves narrowly oblanceolate, an inch long or less, tomentose beneath: bracts subulate-setaceous, short or somewhat elongated, rarely foliaceous: involucres clustered or solitary; tube narrow and scarcely angled, 2 to 2½ lines long, obscurely corrugated; teeth 5, unequal, subulate and uncinate, the larger often foliaceous, 1 to 6 lines long: flower yellow, at length slightly exserted, on a slender pedicel, a line long: segments oblong, acute, slightly villous: stamens 9, at the throat, with very short filaments. — Watson, Bot. King Exp. 313, t. 34.

On the Mohave River (*Palmer*); Northern Nevada, *Torrey, Watson, Lemmon*.

8. LASTARRIÆA, Remy.

Involucre none. Perianth involucre-like, coriaceous or chartaceous, tubular, 5 – 6-cleft to the middle; the narrow teeth rigid and awned, recurved and uncinate. Stamens 3, inserted on the throat, with a small membranous tooth each side of the very short filament. Akene triangular, glabrous. Embryo curved; the narrow cotyledons longer than the radicle. — A small diffusely branching annual, native of Chili, diffusely branched from the base and very fragile, with linear leaves, verticillate oblong or lanceolate uncinately awned floral bracts, and flowers sessile in the forks and terminal.

A single species, with the habit of *Euchorizanthe*.

1. **L. Chilensis**, Remy. Branches procumbent or ascending, 2 to 4 inches long, hirsute: leaves an inch long or less, usually very narrow: lower bracts similar, in whorls of 5; the floral ones 1½ to 3 lines long, concealing the flowers: perianth 1 to 1½ lines long, terete and becoming chartaceous at base: styles very short. — Gay, Fl. Chil. v. 289, t. 58, fig. 1; Meisner in DC. Prodr. xiv. 186; Torr. & Gray, Proc. Am. Acad. viii. 199.

From Contra Costa County to San Diego; perhaps introduced from Chili by the agency of sheep or cattle. It much resembles some species of *Chorizanthe* in appearance, and the flowers are so concealed by the bracts that the plant is liable to be overlooked.

10. PTEROSTEGIA, Fisch. & Meyer.

Involucre of a single bract, subtending and shorter than the solitary sessile flower, rounded and more or less 2-lobed, at length becoming enlarged, scarious and reticulated, loosely enveloping the akene and gibbously 2-saccate on the back. Perianth 6- (rarely 5-) parted; segments oblong-lanceolate, equal. Stamens inserted at the base of the segments, as many or fewer. Akene triangular, glabrous. Cotyledons rounded, accumbent upon the radicle. — Very slender weak leafy annuals,

diffusely dichotomous from the base: leaves opposite, the lower 2-lobed: bracts opposite, small, foliaceous: involucres nearly sessile in the forks and terminal: flowers very small, yellowish. Only the following species.

1. **P. drymarioides**, Fisch. & Mey. Sparingly hirsute, decumbent, the stems often a foot or two long: lower leaves petioled, 2 to 6 lines broad, fan-shaped, the lobes crenately toothed or again lobed; upper leaves obovate to spatulate, entire or toothed: bracts similar, about a line long: involucres very small, becoming 1 to 1½ lines long in fruit, somewhat 2-lobed, the margin toothed or laciniate; the dorsal sacs or crests more or less developed. — Ind. Sem. Hort. Petrop. ii. 23; Benth. in DC. Prodr. xiv. 27; Torr. & Gray, l. c. 200.

Hillsides and dry places, from the Columbia River to Lower California, and from the coast to the foothills of the Sierra Nevada; S. Utah (*Parry*); Guadalupe Island, *Palmer*.

P. MACROPTERA, Benth. Bot. Sulph. 44, is described as a larger and stouter plant, with spatulate somewhat fleshy entire leaves, and the fruiting involucre half an inch broad with a sinuate margin. — Magdalena Bay, Lower California.

ORDER LXXVIII. AMARANTACEÆ.

Herbs (as to our species), with entire leaves destitute of stipules, small flowers which are usually subtended by scarious bracts and have a persistent perianth of 1 to 5 more or less scarious sepals (wanting in *Acnida*), mostly hypogynous stamens as many as the sepals and opposite them or fewer, a 1-celled ovary containing (in our species) a single amphitropous ovule on a slender basal funiculus, utricular in fruit, and lenticular seed with crustaceous (black or brown) testa and embryo curved around copious mealy albumen, its radicle inferior and cotyledons incumbent. Flowers perfect or unisexual, solitary or clustered, commonly 3-bracteate, viz. with a bract and a pair of lateral bractlets; the latter usually more scarious, concave and often carinate. Sepals imbricate in the bud, unchanged in fruit. Stamens either distinct or monadelphous at base, with or without alternating teeth or scales (*staminodia*). Stigmas 2 or 3, sessile or on an undivided style. Utricle either indehiscent or irregularly bursting or circumscissile. Seed always vertical.

An order of unimportant weedy plants, mostly tropical or subtropical, a few cultivated on account of their ornamental bracts or foliage. There are about 40 genera and 400 species. Readily distinguished from the *Chenopodiaceæ* by habit, and by the scarious bracts and sepals.

* Anthers 2-celled.

1. **Amarantus**. Annuals, with alternate thin strongly veined leaves. Flowers monœcious or dicœcious, in close axillary or spicate clusters. Sepals 5 or fewer. Utricle circumscissile.
2. **Nitrophila**. Perennial, with opposite fleshy leaves; glabrous. Flowers perfect, axillary. Sepals 5 to 7, connivent. Utricle indehiscent.

* * Anthers 1-celled: leaves opposite: tomentose.

3. **Cladothrix**. Flowers perfect, axillary. Utricle indehiscent.

1. AMARANTUS, Tourn. AMARANTH.

Flowers usually monœcious or polygamous, sometimes dicœcious, 1 – 3- (mostly 3-) bracted. Perianth of 3 or 5 sepals (rarely fewer in the fertile flowers), distinct or united at base, scarious or scariously margined, erect or the summits spreading and more or less dilated, glabrous. Stamens as many, distinct, with subulate or fili

form filaments and 2-celled anthers; staminodia none. Stigmas 2 or 3, linear and sessile. Utricle 1-seeded, ovate, 2–3-beaked, circumscissile (or indehiscent in § *Euxolus*), often deciduous with the perianth. — Annual weeds, with alternate leaves decurrent upon the slender petiole and apiculate with a short setaceous mucro; flowers green or purplish, in axillary or spiked clusters or spikelets. Staminate flowers usually mingled with the more numerous pistillate ones. — *Amblogyne* & *Euxolus*, Raf. *Sarratia*, Moquin. *Mengea*, Schauer. *Scleropus*, Schrad.

A genus of wide range, some of the species very widely diffused as weeds about cultivated grounds. Among the Indians of Arizona several are cultivated for their abundant seeds. The specific differences are often obscure and badly defined, so that the number of actual species is very uncertain. The views of Bentham (Fl. Australiensis, v. 212) are adopted respecting *Amblogyne*, and there seems also to be no sufficient reason for retaining *Mengea* as a distinct genus.

* *Sepals distinct, oblong-lanceolate, erect: flowers monœcious.*

+ *Flowers in naked terminal and axillary mostly panicled spikes: sepals* 5: *stems usually stout and erect, with large long-petioled leaves.* — EUAMARANTUS.

1. **A. retroflexus**, Linn. Dull green, 1 to 6 feet high, roughish and more or less pubescent, simple or branched: leaves ovate or rhombic-ovate, acute or acuminate, 1 to 3 (or often 4 to 6) inches long, not including the somewhat shorter petiole: flowers green, in thick erect or scarcely spreading crowded axillary and terminal spikes: bracts lanceolate, attenuate to a rigid awn, 1½ to 3 lines long: sepals 1 to 1½ lines long, narrowly oblong, acute or obtuse, or mucronate, at length deciduous with the base of the circumscissile utricle: seed ½ line broad. — Moquin, DC. Prodr. xiii². 258.

From Mexico to British America, only as an introduced weed northward; cultivated by the Arizona Indians. It is also common through most of Europe, but probably not native. Distinguished by the thick erect spikes.

2. **A. chlorostachys**, Willd. Spikes more slender than in the last, linear-cylindric, more or less flexuous, the lateral ones spreading or divaricate: whole plant usually deeper green: the leaves ovate or rhombic-ovate, obtuse or acutish: sepals more frequently acute or acuminate. — Moquin, l. c. 259. *A. retroflexus*, var. *chlorostachys*, Gray, Manual, 412.

Of like range and widely naturalized, but not yet certainly found in California. *A. paniculatus*, Linn., may also occur in gardens, with numerous slender panicled spikes, the flowers and often the leaves tinged with purple.

+ + *Flowers in very small axillary spikes or clusters: sepals* 1 *to* 3: *stems low or prostrate, with smaller leaves.* — PYXIDIUM, Moquin.

++ *Sepals three.*

3. **A. albus**, Linn. Erect or ascending, ½ to 2 feet high, diffusely branched from the base, glabrous or nearly so: stem light-colored: leaves pale green, oblong-spatulate to obovate, ½ to 1½ inches long including the slender petiole, obtuse or retuse, often undulate: rhachis of the 4–5-flowered spikelets often somewhat elongated (½ to 3 lines long): bracts subulate, rigid, pungently awned, 1 to 2½ lines long, the lateral ones very much smaller or wanting: sepals 3, oblong-lanceolate, acuminate, shorter than the slightly rugose utricle: seed small, a third of a line broad. — Moquin, l. c. 264; Watson, Proc. Am. Acad. xii. 274.

Near Monterey (*Hartweg*; referred to *A. Blitum*, var. *græcizans*, by Moquin, l. c. 263), San Diego (*Palmer*), and common through the interior, where it is doubtless indigenous, and in the Atlantic States; also naturalized throughout the Mediterranean region.

4. **A. blitoides**, Watson. Much resembling the last, but prostrate or decumbent, the slender stems ½ to 2 feet long: spikelets usually contracted: bracts ovate-oblong, shortly acuminate, nearly equal, 1 to 1½ lines long, but little exceeding the

oblong obtuse and mucronulate or acute sepals: utricle not rugose, slightly longer than the sepals: seed twice larger than in the last, nearly a line broad. — Proc. Am. Acad. xii. 273.

Also found in the interior from Mexico to Northern Nevada and Iowa, and spreading thence eastward. Somewhat resembling the *A. Blitum*, Linn., of the Old World, which is usually erect, with shorter and more scarious bracts and a smaller seed like that of *A. albus*, notched at the hilum.

\+ + *Sepals and bracts in the fertile flowers solitary.*

5. **A. Californicus**, Watson. Prostrate or ascending, glabrous, branching at the base, the stems often a foot long or more, with numerous short branchlets: leaves obovate to oblong, an inch long or less including the petiole, often small, obtuse or acutish, with white veins and margin: flowers green or reddish, in numerous small dense axillary clusters: bract often membranous and inconspicuous, lanceolate, acuminate, slightly or not at all exceeding the utricle: sepals of the staminate flowers $\frac{3}{4}$ line long; that of the fertile flower shorter and narrower, lateral: utricle slightly rugose, tardily circumscissile: seed half a line broad. — *Mengea Californica*, Moquin in DC. Prodr. xiii^2. 270; Watson, Bot. King Exp. 296.

From San Diego (*Palmer*) to Monterey (*Hartweg*); near Carson City (*Anderson, Torrey*); and northward in Idaho and Oregon.

* * *Sepals* (5) *of the fertile flowers more or less dilated above and spreading, distinct or united at base: flowers sometimes dioecious: perianth deciduous with the fruit.* — AMBLOGYNE. (*Amblogyne*, Raf., Gray. *Sarratia*, Moquin.)

6. **A. fimbriatus**, Benth. l. c. Monœcious, erect, slender, 1 to 3 feet high, sparingly branched or simple, glabrous: leaves linear, an inch or two long, attenuate into a slender petiole, obtuse or acute, obscurely nerved: flowers in rather loose clusters, scattered or approximate in a long terminal spike, which is leafy below: bracts shorter than the perianth, narrow, acute: sepals of the sterile flowers obtuse, oblong; those of the fertile flowers broadly fan-shaped, 1 to 1$\frac{1}{2}$ lines long, with a narrow thickened strongly nerved base, slightly united, the upper margin fimbriately incised: seed round-ovate, less than half a line broad. — *Sarratia Berlandieri*, var. *fimbriata*, Torrey, Bot. Mex. Bound. 179. *Amblogyne fimbriata*, Gray, Proc. Am. Acad. v. 168.

From San Diego County eastward to S. Utah and the Rio Grande, and southward to Cape St. Lucas, *Xantus*.

7. **A. Palmeri**, Watson. Dioecious, rather stout, erect, 2 or 3 feet high, branching, somewhat pubescent above or glabrate: leaves oblong-rhomboid, an inch or two long and about equalling the petiole, the upper linear-lanceolate: flowers in close elongated linear spikes leafy at base: bracts solitary, mostly twice longer than the flowers, spreading, subulate and rigid, narrowed into a stout awn: sepals of fertile flowers 1 to 1$\frac{1}{2}$ lines long, oblong and somewhat broader above, obtuse or retuse, two or three usually slightly larger and more acute or setaceously apiculate, distinct or nearly so: stigmas usually 2: seed circular, half a line broad. — Proc. Am. Acad. xii. 274.

At Larkin's Station, east of San Diego, *Palmer*, 1875 (n. 323). Also on the banks of the Rio Grande, *Berlandier*, 1834 (n. 2407). Staminate flowers have not been detected on the fruiting specimens. What is probably to be considered the staminate form has been collected on the Rio Grande and in the Gila Valley by several collectors, on the Fort Yuma road, 80 miles east of San Diego (*Palmer*), and at Cape St. Lucas, *Xantus*. These accord in habit and foliage with the pistillate specimens, and have very narrowly acuminate or setaceous pungent bracts equalling or usually exceeding the lanceolate long-acuminate sepals.

A. TORREYI, Benth. (*Amblogyne Torreyi*, Gray), is a similar species of Colorado and New Mexico, and also from Cape St. Lucas, distinguished by the less rigid bracts scarcely as long as the flowers and the broader obovate-spatulate sepals, rounded above and entire or retuse or emarginate; sepals of the male flowers (which are mingled with the pistillate ones or on distinct plants) oblong-lanceolate, acute.

2. NITROPHILA, Watson.

Flowers perfect, mostly 2-bracted. Perianth of 5 (rarely 6 or 7) equal erect concave and carinate sepals. Stamens as many, united at base into a very narrow perigynous disk: anthers 2-celled: staminodia none. Style short: stigmas 2, slender. Utricle subglobose, indehiscent, 1-seeded, beaked by the persistent style, included within the connivent sepals. — A low perennial branching glabrous herb, with fleshy opposite amplexicaul leaves, and axillary sessile or shortly pedicellate flowers. — Bot. King Exp. 297. *Banalia* § *Idiopsis*, Moquin, DC. Prodr. xiii². 279.

1. **N. occidentalis**, Watson, l. c. Stems ascending or decumbent, 3 to 8 inches high, from a perennial running rootstock, branching from the base and angular: lowermost leaves broadly ovate or oblong, 2 or 3 lines long; the rest linear, 6 to 12 lines long, semiterete, acuminate and cuspidate: bracts similar but shorter, mostly twice longer than the flowers: flowers 1 to 3 in each axil; the lateral ones frequently short-pedicelled, 2 – 3-bracted, the central one often bractless: sepals a line long, rather rigid, ovate, acutish, exceeding the stamens and style: utricle brownish: seed half a line broad, black and shining. — *Banalia occidentalis*, Moquin, l. c.

In moist ground near alkaline springs; Oregon (*Nuttall*); Lower Sacramento (*Pickering*); Providence Mountains (*Cooper*); Western Nevada, *Stretch*, *Watson*.

3. CLADOTHRIX, Nutt.

Flowers perfect, 3-bracted; bracts concave, hyaline. Perianth of 5 erect equal oblong rigid-scarious sepals, somewhat pilose with verticillately branched hairs. Stamens 5, the filaments united at base into a short cup: anthers large, oblong, 1-celled. Ovary subglobose: style short; stigma capitate, 2-lobed. Utricle ovate-globose, indehiscent, 1-seeded. — Low annual, or erect and woody at base, densely stellate-tomentose, with opposite small rounded entire petiolate leaves, and very small flowers solitary or few in the axils. — Benth. & Hook. Gen. Pl. iii. 37.

Only the two following species are known.

1. **C. lanuginosa**, Nutt. in herb. Annual, prostrate or ascending, diffusely branched, densely white-tomentose becoming glabrate; stems often a foot or two long: leaves round-obovate to rhomboidal, more or less attenuate at base, 3 to 10 lines long, often in threes, two of them smaller: flowers mostly in pairs; sepals less than a line long, obtusish, twice longer than the broader hairy-tipped bracts: utricle glabrous, shorter than the sepals. — *Achyranthes lanuginosa*, Nutt. Fl. Ark. 166. *Alternanthera* (?) *lanuginosa*, Torr. in Emory's Rep. 150, and Bot. Mex. Bound. 180; Moquin, DC. Prodr. xiii². 359.

Banks of the Colorado near Chimney Peak (*Newberry*), and eastward to Arkansas and Texas.

C. SUFFRUTICOSA, Benth. & Hook. Somewhat woody at base, erect and much branched, half a foot high or less: leaves rounded or ovate, truncate or usually rounded at base, 2 to 6 lines long, very shortly petioled. — *Alternanthera* (?) *suffruticosa*, Torr. in Bot. Mex. Bound. 181. Valley of the Rio Grande, *Wright*.

ORDER LXXIX. CHENOPODIACEÆ.

Herbs or shrubs, often succulent or scurfy, sometimes fleshy and leafless, usually with simple and alternate leaves, without stipules; the small and sessile commonly clustered flowers either naked or with herbaceous (not scarious) bracts, a perianth of 5 or fewer usually herbaceous and persistent sepals, often changed in fruit

(becoming appendaged, winged, baccate, etc.), or sometimes wanting in the fertile flowers; stamens as many as the sepals and opposite them or fewer, distinct, with 2-celled anthers; ovary 1-celled, containing a solitary amphitropous or campylotropous ovule on a funicle rising from its base, an akene or utricular in fruit; embryo slender, either annular, and surrounding the mealy albumen, or spiral with the albumen lateral or wanting. Flowers either perfect or unisexual. Bracts often enclosing the fruit. Sepals imbricated in the bud. Styles or stigmas 1 to 4. — Moquin in DC. Prodr. xiii². 41. Watson, Proc. Am. Acad. ix. 82.

A wide-spread order of about 60 genera and 400 species, mostly extra-tropical and in large degree peculiar to maritime or saline localities, and including some cosmopolitan weeds. It is extensively represented in the desert and alkaline regions of Western America (most of the various plants that are popularly known as "Grease Wood" belonging to it), as in Asia and the Mediterranean region. It furnishes the Beet (*Beta vulgaris*, Linn.), which has been cultivated for ages, and the Mangel Wurzel (*B. Cicla*, Linn.); several species, as Spinach (*Spinacia oleracea*, Linn.) and the Garden Orach (*Atriplex hortensis*, Linn.), are used as potherbs; and the seeds of others are used for food by the Indians of North and South America. Some possess aromatic and medicinal properties, and others contain large quantities of alkaline salts.

Tribe I. CHENOPODIEÆ. Flowers perfect, without bracts; the perianth persistent. Seed free, mostly with crustaceous testa and copious albumen. Embryo annular. Stems not articulated, nor leaves terete except in *Kochia*.

* Seeds horizontal (sometimes vertical in *Chenopodium*).

1. **Kochia**. Perianth 5-cleft, at length transversely winged, enclosing the fruit. Stamens 5. Testa membranous and albumen none. Perennial, with terete leaves and axillary flowers.
2. **Aphanisma**. Perianth 3-cleft, not appendaged, persistent at the base of the fruit. Stamen 1. Glabrous annual, with ovate entire leaves, and minute axillary flowers.
3. **Teloxys**. Perianth of 5 carinate sepals, partly covering the fruit. Stamen 1 or none. Annual, repeatedly dichotomous, with lanceolate toothed leaves, and axillary or terminal solitary flowers.
4. **Chenopodium**. Perianth usually 5-cleft or -parted, nearly covering the fruit. Stamens 5 or fewer. Mostly mealy or glandular, with the clustered flowers axillary or in axillary and terminal spikes. Seed in some species often vertical.

* * Seeds vertical.

5. **Monolepis**. Sepal 1, bract-like. Stamen 1. Fruit naked. Low annuals; flowers densely clustered in the axils.
6. **Roubieva**. Perianth 3–5-toothed, becoming saccate and enclosing the fruit. Perennial herb, with pinnatifid leaves; flowers solitary or few in the axils.

Tribe II. ATRIPLICEÆ. Flowers monœcious or diœcious; the staminate with 3–5-cleft perianth; the pistillate without perianth, enclosed in a pair of more or less united bracts. Seed free, vertical, with annular embryo and copious albumen. Stems not articulated nor leaves fleshy.

* Bracts compressed: testa mostly coriaceous.

7. **Atriplex**. Fruiting bracts with margins often dilated and sides often muricate. Radicle from inferior to superior.

* * Bracts obcompressed, completely united, not muricate: testa membranous: radicle inferior.

8. **Eurotia**. Pericarp conical, somewhat obcompressed, densely hairy, not winged. Low and shrubby, white-tomentose.
9. **Grayia**. Pericarp flattened, orbicular, wing-margined, glabrous. Shrubby, somewhat spinescent, nearly glabrous.

Tribe III. CORISPERMEÆ. Flowers perfect, bractless. Sepals 1 to 3, hyaline, marcescent. Pericarp adherent to the vertical seed. Embryo annular around copious albumen. Stems not articulated nor leaves fleshy.

10. **Corispermum**. Fruit compressed-elliptic, acutely margined, not muricate: flowers solitary, axillary. Low annual.

TRIBE IV. SALICORNIEÆ. Flowers mostly perfect, immersed by threes in the depressions of a close cylindrical spike. Seeds vertical. Embryo annular, with little albumen. Fleshy saline plants, with jointed stems and scale-like leaves.

11. **Salicornia.** Flower-clusters decussately opposite: perianth saccate, becoming spongy. Branches opposite.
12. **Spirostachys.** Flower-clusters in spirals: perianth 4–5-cleft. Branches alternate.

TRIBE V. SUEDEÆ. Embryo spiral, with little or no albumen. Leaves fleshy, terete. Stems not articulated.

13. **Sarcobatus.** Flowers unisexual; the staminate in aments, without perianth; the pistillate axillary, solitary, with saccate perianth. Fruit transversely winged. Saline shrub, somewhat spinescent.
14. **Suæda.** Flowers perfect, axillary; perianth 5-cleft or -parted. Saline herbs, or woody at base.

1. KOCHIA, Roth.

Flowers perfect (or the stamens abortive), without bracts. Perianth herbaceous, subglobose, 5-cleft, persistent over the fruit, and at length usually developing an entire or lobed horizontal wing. Stamens 5, usually exserted. Ovary depressed: styles 2, filiform. Pericarp membranous, persistent. Seed horizontal; testa membranous. Embryo nearly annular, green, enclosing scanty albumen. — Perennials, woody at base, with scattered linear terete leaves, and the flowers solitary or few in the axils of the virgate leafy stems.

An Australian and Old World genus of about 25 species, with a single representative in America.

1. **K. Americana,** Watson. Woody and branching at base: the erect stems mostly simple and virgate, ½ to 1½ feet high, leafy, villous-tomentose or nearly glabrous: leaves 3 to 12 lines long, acutish, ascending: flowers 1 to 3 in the axils, mostly with abortive stamens: perianth densely white-tomentose, nearly a line broad in fruit; the membranous wing as wide or wider, its lobes cuneate-rounded, nerved and somewhat crenulate: ovary ovate, tomentose above: styles elongated: pericarp nearly smooth: seed ⅔ of a line broad. — Rev. Chenop. in Proc. Am. Acad. ix. 93. *K. prostrata,* Hook. in Kew Journ. Bot. v. 262, not Schrader; Watson, Bot. King Exp. 293.

Valleys and foothills of the Great Basin, from Northwestern Nevada to W. Wyoming and southward to Arizona; doubtless in Northeastern California.

2. APHANISMA, Nutt.

Flowers perfect, without bracts. Perianth 3-cleft, with concave segments, unchanged in fruit. Stamen solitary; filament short. Ovary depressed: style short, shortly 2–3-cleft. Pericarp rather thick and indurated, somewhat 5-angled, the base surrounded by the dry calyx. Seed horizontal, with very thin crustaceous testa. Embryo annular, surrounding the copious albumen. — A slender glabrous annual, with alternate sessile entire leaves, and minute axillary mostly solitary flowers. A single species.

1. **A. blitoides,** Nutt. Stems ascending, branched, 1 to 2½ feet high: leaves thin, oblanceolate, ovate-oblong, the upper ones ovate, acute, 3 to 12 lines long: segments of the minute perianth ovate, very obtuse, thin and closely appressed to the base of the fruit: fruit half a line broad: seed punctulate-rugose, shining. — Moquin in DC. Prodr. xiii². 54; Watson, l. c. 90.

Near San Diego; very sparingly collected, *Nuttall, Cleveland.*

3. TELOXYS, Moquin.

Flowers perfect or sometimes pistillate, without bracts. Perianth 5- (rarely 4-) parted; the lobes more or less prominently carinate or somewhat crested, loosely and only partially covering the fruit. Stamen solitary. Styles 2, distinct or united at base. Pericarp membranous. Seed horizontal, with a crustaceous testa. Embryo annular around copious albumen. — Erect diffusely branched annuals, with thin alternate leaves, and minute solitary flowers, very shortly pedicelled, axillary and terminal upon the repeatedly dichotomous nearly naked branches.

Only three species, of Northern Asia, central North America, and the Bolivian Andes, respectively.

1. **T. cornuta,** Torrey. Glabrous or somewhat glandular-puberulent, ½ to 1½ feet high, slender: leaves lanceolate, an inch or two long, repand-dentate or coarsely sinuate-pinnatifid: calyx resinous-dotted, the acute lobes carinate with a short thick crest: seed ¼ of a line broad. — Pacif. R. Rep. iv. 129; Watson, l. c. 91.

Near Prescott, Arizona (*Palmer*), and probably ranging into S. E. California, thence to Colorado and Northern Mexico.

4. CHENOPODIUM, Tourn. Goosefoot. Pigweed.

Flowers perfect or sometimes pistillate, without bracts. Perianth herbaceous, 5- (rarely 3–4-) parted; lobes usually somewhat carinate or crested, becoming dry and more or less closely covering the fruit, or rarely at length fleshy. Stamens 5 or fewer. Styles 2, rarely 3 or 4, slender. Pericarp membranous, closely investing the lenticular or subglobose horizontal or vertical seed. Testa crustaceous. Embryo annular or curved around copious albumen. — Annuals, rarely perennial; many of them introduced weeds, usually more or less white-mealy or glandular; leaves alternate, petioled; flowers sessile and clustered, in axillary or terminal interrupted spikes or panicled. — *Blitum,* Tourn.

A widely distributed genus of about 50 species, some of them among the most common weeds in almost all countries. Eight or nine species are native to the interior and southern portions of the United States. The limits of the genus, as distinct from *Blitum,* are very vague, and variously drawn. Any division based upon the variable position of the seed and consistence of the calyx appears to be unsatisfactory, and it has seemed best to include all our species in the one genus.

§ 1. *Annual, usually somewhat mealy, but not pubescent or glandular, nor aromatic: fruiting calyx dry: seed lenticular, horizontal: embryo completely annular.* — Chenopodiastrum, Moquin.

* *Pericarp closely persistent: leaves more or less sinuate-dentate: seed large (¾ line broad).*

1. **C. album,** Linn. Erect and often strict, usually 2 to 4 feet high, simple or branched, more or less mealy: leaves rhombic-ovate, 1 to 3 inches long, obtuse or acute, at least the lower ones sinuate-dentate, the upper usually entire and lanceolate to linear: flowers densely clustered in usually close spikes, the panicle strict and close or somewhat spreading: sepals strongly carinate, nearly or quite covering the fruit: seed ¾ to nearly a line broad.

A common weed, introduced everywhere, originally from the Old World; usually known as "Pigweed" or "Lamb's Quarters." The var. *viride,* less mealy and with more open inflorescence, is less prevalent on the western coast than eastward.

2. **C. murale,** Linn. Stout, erect or decumbent, a foot or two high, more or less mealy: leaves broadly rhomboidal or triangular to lanceolate, 1 to 4 inches

long, acute, coarsely and deeply sinuate-toothed: flowers in small clusters, in axillary rather loose spicate panicles shorter than the leaves, or in a naked open terminal panicle: seed sharply margined.

Introduced; chiefly near the coast, from San Francisco to San Diego. An Old World species, now common around the globe.

C. HYBRIDUM, Linn. Glabrous throughout or only the inflorescence mealy, rather stout, erect, 2 to 4 feet high, simple or sparingly branched above: leaves usually large, 2 to 8 inches long, broadly ovate-triangular, acuminate, somewhat cordate at base, sinuate with 2 or 3 large teeth on each side: flowers in small clusters in slender diffuse terminal and axillary panicles: seed larger, margin acutish. — Another widely dispersed weed, but apparently indigenous in the mountains of the interior from Washington Territory to Colorado and New Mexico; not yet reported from California.

* * *Pericarp separating readily from the seed: leaves entire or hastately lobed: seed smaller.*

3. **C. Fremontii,** Watson. Erect, slender, branching, ½ to 2 feet high, more or less mealy: leaves broadly triangular-hastate, ¼ to 1 inch long, obtuse or abruptly acute, truncate or cuneate at base, the upper rarely becoming oblong to linear-lanceolate: flowers often small, white-mealy, scattered in small clusters upon the slender open-panicled branchlets, or the inflorescence sometimes stouter and more contracted: sepals strongly carinate: seed one to two thirds of a line broad. — Bot. King Exp. 287; Rev. Chenop. 94.

Near Fort Mohave (*Cooper*), and through the interior from the base of the Sierra Nevada to Colorado and New Mexico.

4. **C. leptophyllum,** Nutt. Erect, often strict, ½ to 3 feet high, simple or branched, densely mealy or often nearly glabrous: leaves linear, entire, a half to an inch long, acute and usually mucronate, rather shortly petioled: flowers in small dense clusters in dense or interrupted spikelets: sepals strongly carinate, acute: seed half a line broad. — Watson, Rev. Chenop. 94. *C. album,* var. *leptophyllum,* Moquin in DC. Prodr. xiii^2. 71.

In the valleys and mountains from the eastern base of the Sierra Nevada to Dakota and New Mexico; also on the sea-coast from Rhode Island to New Jersey.

§ 2. *Annual, not mealy, more or less glandular-pubescent, aromatic: seed very small, not exceeding the dry perianth, often vertical: embryo curved.* — BOTRYOIS, Moquin.

* *Flowers paniculate or spicate: seeds mostly horizontal, obtusely margined.*

5. **C. Botrys,** Linn. Glandular throughout, erect, a foot or two high, branched: leaves ovate to oblong, an inch or two long, sinuately pinnatifid and the lobes usually toothed: flowers somewhat solitary, in numerous slender diffuse axillary panicles: sepals acute, loosely covering the fruit: pericarp persistent: seed scarcely a third of a line broad.

Sparingly introduced on the Pacific Coast, but common eastward and over much of the Old World; near Pyramid Lake, *Lemmon.* Originally from S. Europe, and frequently cultivated for medicinal purposes; popularly known as "Jerusalem Oak."

6. **C. ambrosioides,** Linn. Scarcely glandular, erect or ascending, usually stout and branched, 2 or 3 feet high: leaves lanceolate, shortly petioled, 2 to 5 inches long, sinuate-dentate; the upper often small, linear-lanceolate and entire: flowers in axillary clusters or usually in numerous slender axillary often elongated spikes along the leafy branches: sepals obtuse, appressed to the fruit: pericarp deciduous.

Introduced from tropical America, and a common weed in many parts of the world, often used as a vermifuge under the name of "Wormseed"; in salt-marshes and waste places about San Francisco and southward to San Diego; Lake Tahoe, *Lemmon.* The var. *anthelminticum,* with more coarsely toothed leaves and elongated leafless spikes, may also be found.

* * *Flower-clusters all axillary: seeds mostly vertical, acutely margined.*

7. **C. carinatum,** R. Brown. Stems prostrate or procumbent, a half to a foot long or more, leafy: leaves oblong-lanceolate, sinuately pinnatifid, an inch long or often much less, on slender petioles: flowers small, in rather loose clusters in all the axils: sepals incurved, linear-oblong, somewhat thickened on the back: stamens usually solitary: seed a fourth of a line broad. — Benth. Fl. Austral. v. 102. *Blitum carinatum* & *B. glandulosum,* Moquin, DC. Prodr. xiii^2. 81.

An Australian species, found in yards and fields in Plumas County (*Lemmon, Mrs. Ames*); doubtless introduced.

§ 3. *Perennial, somewhat mealy, not glandular-pubescent: fruiting calyx dry: seed large, subglobose, vertical, exserted: embryo annular.* — AGATHOPHYTON. (*Blitum* § *Agathophyton,* Moquin.)

8. **C. Californicum,** Watson. Stout, erect, mostly simple, a foot or two high, from a thick fusiform root: leaves broadly triangular-hastate, 2 or 3 inches long, acute or acuminate, truncate or sinused at base, sharply and unequally sinuate-dentate: flowers in dense clusters in simple terminal spikes: perianth campanulate, more or less deeply 5-toothed, loosely enveloping the fruit: pericarp persistent: seed somewhat compressed, $\frac{3}{4}$ to 1 line broad. — *C. anthelminticum,* var. (?) *hastatum,* Moquin, l. c. 74. *Blitum Bonus-Henricus,* var. *erosum,* Moquin, l. c. 85. *Blitum Bonus-Henricus,* Torrey, Pacif. R. Rep. iv. 129. *Blitum Californicum,* Watson, Rev. Chenop. 101.

From the Sacramento to Fort Tejon and San Diego; known in the southern part of the State as "Soap-plant," and used for cleansing purposes. It much resembles the European species, *C. Bonus-Henricus,* Linn., formerly often cultivated as a potherb.

§ 4. *Annual, glabrous calyx becoming more or less fleshy in fruit and often colored: seed subglobose, mostly vertical, small: flowers in crowded clusters, axillary or in spikes* — BLITUM.

9. **C. rubrum,** Linn. Stout, erect, branching, 1 to 3 feet high: leaves triangular-hastate to lanceolate, 2 or 3 inches long, acute, cuneate at base, sparingly sinuate-dentate, the upper narrowly lanceolate and entire: flower-clusters densely spicate upon the leafy branchlets: sepals 2 to 5, obtuse, rather fleshy: stamens 1 or 2, or 5 in the terminal flowers: perianth deciduous: seed occasionally horizontal, the margin obtuse or acutish, a third of a line broad. — *Blitum maritimum,* Nutt.; Gray, Manual, 408. *B. polymorphum,* C. A. Meyer; Watson, Bot. King Exp. 288. *B. rubrum,* Reichenb.; Watson, Rev. Chenop. 99.

Var. **humile.** Smaller, prostrate or ascending: leaves ovate to lanceolate, often hastate, an inch long or less, rarely toothed: flowers in axillary or somewhat spicate clusters. — *C. humile,* Hook. Fl. Bor.-Am. ii. 127. *Blitum rubrum,* var. *humile,* Moquin, l. c.

In saline or alkaline soils through the interior and eastward, and in British America; Klamath Lake (*Newberry*); San Diego desert, *Palmer.* A variable species, common also in Europe and Northern Asia; ambiguous between *Chenopodium* proper and the typical *Blitum.*

10. **C. capitatum.** A similar species, with leaves usually more broadly triangular, often somewhat hastate, more acutely sinuate-toothed: flower-clusters mostly large, in interrupted terminal naked spikes and solitary in the axils of the upper leaves: calyx becoming fleshy in fruit, and the clusters red and berry-like: seed somewhat acutely margined, the pericarp adherent. — *Blitum capitatum,* Linn.; Moquin, l. c. 83; Watson, Rev. Chenop. 100.

In the mountains from Washington Territory to the Saskatchewan and southward to Utah and New Mexico, also east along the Great Lakes; Sierra County (*Lemmon*); apparently identical with the plant of Central Europe and Siberia. The pulpy bright red calyx gives to the large clusters when ripe the appearance of strawberries, whence the popular name "Strawberry Blite."

5. MONOLEPIS, Schrader.

Flowers polygamous, without bracts. Perianth of a single persistent scale-like or bract-like sepal, not appendaged, becoming dry in fruit. Stamen 1. Styles 2, filiform. Pericarp membranous, persistent upon the vertical flattened seed. Embryo annular or curved around copious albumen; radicle inferior. — Low saline annuals, glabrous or somewhat mealy, with small alternate petioled fleshy leaves: flowers small, in axillary clusters.

A small genus, mostly confined to the interior of North America, including two northern Asiatic species besides the following.

1. **M. chenopodioides,** Moquin. Branched from the base: stems 3 to 12 inches long, ascending, leafy: leaves lanceolate-hastate or sometimes narrowly spatulate, a half to one inch long, entire or sparingly sinuate-dentate, acute or obtuse, cuneate or attenuate at base, the upper nearly sessile; lower petioles elongated: flower-clusters dense, often reddish: sepal fleshy and foliaceous, oblanceolate or spatulate, often much exceeding the fruit: pericarp fleshy, becoming dry and minutely pitted, adherent: seed lenticular, or often reniform with a curved embryo, the margin acutish, half a line long. — DC. Prodr. xiii². 85, excl. var.; Watson, Rev. Chenop. 102. *Blitum chenopodioides,* Nutt.

Throughout the interior, from the Saskatchewan to Northeastern California, Texas and Arizona; Sierra County, *Lemmon.*

2. **M. spathulata,** Gray. Resembling small specimens of the last; leaves all narrowly oblanceolate or spatulate, half an inch long or less, entire: flowers smaller; sepal rarely exceeding the fruit: pericarp minutely papillose, separating from the minute shining seed, which is less than a quarter of a line broad. — Proc. Am. Acad. vii. 389; Watson, l. c.

In the Sierra Nevada; at Mono Pass (*Bolander*) and in Sierra County, *Lemmon.*

3. **M. pusilla,** Torrey. Very slender, erect, diffusely and dichotomously much branched from the base, 2 to 6 inches high, often reddish: leaves oblong, obtuse, entire, scarcely petioled: flowers solitary or few in the clusters, minute: sepals (1 to 3) much shorter than the fruit and evanescent: pericarp thin, adherent, minutely tuberculate: seed less than a quarter of a line broad. — Watson, Bot. King Exp. 291; Rev. Chenop. 102.

On the dry alkaline flats of Northwestern Nevada, and doubtless of Northeastern California; a very distinct and interesting species.

6. ROUBIEVA, Moquin.

Flowers perfect or pistillate, without bracts. Perianth deeply campanulate, 3–5-toothed, at length saccate and contracted over the fruit, 3–5-nerved and net-veined. Stamens 5, included. Ovary glandular at the top: styles 3, somewhat lateral, exserted. Pericarp membranous, glandular-dotted, thin and deciduous. Seed vertical, lenticular; testa crustaceous. Embryo annular, around copious albumen. — A perennial glandular heavy-scented South American herb, with alternate pinnatifid leaves: flowers solitary or few in the axils.

1. **R. multifida,** Moquin. Prostrate or ascending, branching and leafy; stems a foot long or more: leaves lanceolate to linear, ½ to 1½ inches long, acute, deeply pinnatifid with narrow lobes: fruiting calyx obovate, nearly a line long: seed small. — DC. Prodr. xiii². 80; Watson, l. c. 99.

Very sparingly introduced; Plumas County, *Mrs. Ames.* Allied to section *Botryois* of *Chenopodium,* to which genus it is sometimes referred.

7. ATRIPLEX, Tourn.

Flowers monœcious or diœcious. Staminate flowers without bracts: perianth 3–5-cleft or -parted: stamens as many. Pistillate flowers 2-bracteate, without perianth or rarely with 2 to 4 distinct hyaline sepals. Bracts erect and appressed, distinct or more or less united, becoming enlarged and enclosing the fruit, the margins at length often dilated and the sides thickened or indurated and muricate. Styles 2, filiform. Fruit compressed; pericarp thin and membranous. Seed vertical, with a thin crustaceous or coriaceous testa. Embryo annular, surrounding copious albumen; radicle inferior, superior, or lateral. — Herbs or shrubs, mealy or scurfy; leaves alternate or rarely opposite; flowers usually clustered, axillary or in simple or panicled spikes, the sexes distinct or mingled in the clusters. — *Obione*, Moquin. *Pterochiton*, Torrey.

About 120 species, distributed over most parts of the globe, mainly along the sea-coasts or in other saline localities; a few cultivated as potherbs. Fully a third of the species is found in the United States, especially in the dry and alkaline portions of the interior and southern regions, forming a considerable part of the characteristic vegetation of such places. The most obvious specific characters are drawn in many cases from the fruiting bracts, which vary much with age; hence the satisfactory determination of young flowering specimens may be difficult.

* Annuals, somewhat succulent and mealy: leaves triangular-hastate, large: bracts distinct, mostly triangular or hastate, usually foliaceous-margined.

Spikes naked: male flowers small: lower leaves opposite: seed a line broad. On the coast. — 1. A. PATULA.
Flowers axillary, subdiœcious; male calyx larger, 5-parted: leaves alternate, entire: styles included: seed small. Interior. — 2. A. PHYLLOSTEGIA.
Spikes naked: calyx large, 4-parted: leaves alternate, coarsely toothed: styles exserted: seed minute. Interior. — 3. A. SPICATA.

* * Annuals, not succulent, mealy or scurfy: leaves smaller: bracts not greatly enlarged, more or less united, sessile, rarely triangular or hastate.

Fruiting bracts very small, ovate, entire, not margined or appendaged.
Low, very slender: leaves ovate to oblong. — 4. A. PUSILLA.
Fruiting bracts small, cuneate or rounded, herbaceously margined and toothed: leaves alternate, not triangular or hastate.
Bracts cuneate-orbicular, not margined below the middle,
The truncate summit shortly 3-toothed: leaves cordate-ovate, entire: erect, rather stout. — 5. A. TRUNCATA.
Summit rounded, shortly 3–7-toothed: leaves oblong, small, entire: decumbent, slender. — 6. A. MICROCARPA.
Margin rounded, gash-toothed: leaves lanceolate, sinuate-dentate: branches spreading, flexuous. — 7. A. BRACTEOSA.
Margin rounded, with short blunt teeth: leaves narrowly lanceolate, entire: erect, slender, virgate. — 8. A. COULTERI.
Bracts orbicular, surrounded by a gash-toothed margin.
Erect, stout: leaves lanceolate, entire: bracts 2 to 2½ lines broad. — 9. A. CORONATA.
Fruiting bracts triangular-cordate, coriaceous, not margined: leaves ovate-oblong, opposite, sessile: decumbent. — 10. A. DECUMBENS.
Fruiting bracts 2 to 4 lines long, indurated or spongy, rhombic-ovate, united, the convex sides usually conspicuously muricate and the margin toothed.
Leaves broad obovate to ovate-oblong, alternate, entire: decumbent. — 11. A. LEUCOPHYLLA.
Leaves triangular-hastate to rhombic-ovate, the lower opposite.
Staminate spikes short, dense: leaves petioled. — 12. A. ARGENTEA.
Staminate spikes long and slender: leaves sessile: branches distant. — 13. A. EXPANSA.

* * * Perennial, mostly diœcious and woody, densely scurfy: leaves mostly alternate.

Fruiting bracts small, suborbicular,
Somewhat spongy, muricate, margin toothed: erect shrub with small entire sessile leaves. — 14. A. POLYCARPA.

Membranous or spongy, not muricate nor margined.
Monœcious, herbaceous and procumbent, leafy: leaves sessile, the lower opposite. 15. A. CALIFORNICA.
Dioecious, erect and shrubby: spikes in naked panicles: leaves petioled, ovate to triangular-hastate.
Branches terete, divaricate, rarely spinescent: bracts compressed, united to above the middle. 16. A. LENTIFORMIS.
Branches angled, spinescent: bracts compressed, distinct. 17. A. TORREYI.
Branches terete, unarmed: bracts convex, united to the middle. 18. A. BREWERI.
Fruiting bracts large, thick and scurfy, united at base, not muricate, the rounded margins free and entire: erect shrubs.
Bracts sessile: leaves ovate to oblanceolate, entire, nearly sessile. 19. A. CONFERTIFOLIA.
Bracts pedicellate: leaves rounded, acutely dentate, petioled. 20. A. HYMENELYTRA.
Fruiting bracts connate, not scurfy nor muricate, with four distinct broad veined and entire or toothed wings: erect shrub, with oblanceolate to linear leaves. 21. A. CANESCENS.

* *Monœcious annuals, mostly erect, branching, somewhat succulent and mealy: leaves triangular-hastate, at least the lower ones, rather large: bracts distinct or nearly so, ovate-oblong to broadly triangular or hastate, the margin and apex usually foliaceous in fruit: radicle inferior or ascending.*

1. **A. patula,** Linn. Usually stout, decumbent or erect, 1 to 4 feet high, dark green and smooth or somewhat mealy: leaves lanceolate to broadly triangular-hastate, obtuse or acute, entire or coarsely sinuate-toothed, 1 to 4 inches long, petioled, the lower opposite: flower-clusters dense, in naked spikes or panicles, usually largely pistillate: staminate calyx small, 5-parted: bracts ovate-rhombic to broadly triangular or hastate, very variable, often becoming 3 to 6 lines long, mostly sessile, the margin usually foliaceous, entire or toothed, the sides sometimes muricate: seed dark, about a line broad: radicle lateral.

A species common to this country and the Old World, ranging across the continent, in saline or brackish localities. The broad leaved form, var. *hastata,* Gray, is frequent in salt-marshes near San Francisco. The more slender var. *littoralis,* Gray, with linear-lanceolate or linear leaves, rarely hastate or toothed, is found on the Columbia River, and probably occurs farther southward. The bracts vary greatly in size and form, scarcely exceeding the seed or very large and conspicuous. The leaves are equally diverse, and several species and numerous varieties have been based upon the various forms of the plant.

2. **A. phyllostegia,** Watson. Erect, ½ to 1½ feet high, scurfy-mealy or at length glabrous: leaves alternate, rhombic-ovate to triangular or hastate, ½ to 2 inches long, acute or acuminate, entire or sparingly sinuate, the lower on slender petioles: flowers nearly dioecious, mostly axillary: staminate calyx 5-parted, a line broad: bracts linear-lanceolate to cordate-ovate, acute or acuminate, becoming 2 to 6 lines long and 2 lines wide, sessile or pedicellate, foliaceous; the sides somewhat indurated in fruit, 3-nerved, the lateral nerves often bi-tuberculate and spongy: pedicels broader and often spongy above, 3 lines long or less: styles included: seed brownish, scarcely ½ line broad: radicle nearly superior. — Rev. Chenop. 108. *Obione phyllostegia,* Torrey; Watson, Bot. King Exp. 291.

Hillsides and valleys, in subalkaline soil, in Southern California and Western Nevada; Mohave Valley (*Cooper*); near Ojai, *Peckham.* Apparently nearly as variable as the last; very distinctly marked in fruit.

3. **A. spicata,** Watson. Stout, erect, 2 feet high, mealy: leaves alternate, rhombic-ovate, acute, coarsely and irregularly sinuate-toothed, about 2 inches long, attenuate to a short petiole: flowers mostly staminate, in dense axillary and terminal naked and somewhat paniculed spikes: staminate calyx large, 4-parted with broad rounded lobes: bracts nearly concealed by the male flowers, 1½ lines long, ovate-oblong, apparently not greatly enlarged in fruit: styles long and exserted: nearly mature seed ¼ line broad: radicle inferior. — Rev. Chenop. 108.

San Joaquin Valley, east of Mount Diablo, in alkaline soil, *Brewer.* Sparingly collected, and mature specimens unknown.

* * *Monœcious annuals, not succulent, mostly low, more or less white-puberulent or scurfy: leaves mostly small: bracts not greatly enlarged in fruit, more or less united, sessile: radicle superior (except in* n. 4).

+ *Fruiting bracts very small, united, not indurated, ovate, entire, not margined or in any way appendaged.*

4. **A. pusilla,** Watson. Very slender, much branched from the base and leafy, erect, 3 to 6 inches high, hoary: leaves broadly ovate to oblong-lanceolate, 2 to 4 lines long or the floral ones much smaller, acute, entire, sessile: flowers minute, solitary, or one of each sex in the axils: calyx deeply 5-cleft: fruiting bracts half a line long, acutish, compressed: styles exserted: seed nearly filling the sac; testa thin. — Rev. Chenop. 110. *Obione pusilla,* Torrey; Watson, Bot. King Exp. 291.

In alkaline valleys, Northwestern Nevada.

+ + *Fruiting bracts small, more or less united, somewhat indurated, herbaceously margined at least at the summit and toothed; the sides sometimes muricate, somewhat* 3*-nerved: leaves alternate, not triangular or hastate.*

++ *Bracts cuneate-orbicular, less than* 1½ *lines broad, united to above the middle, only the truncate or rounded summit margined.*

5. **A. truncata,** Gray. Hoary, rather stout, erect and mostly strict, 1 to 3 feet high, simple or sparingly branched: leaves broadly ovate to lanceolate, acute, truncate or cordate at base, sessile or the lower shortly petioled, ½ to 1½ inches long: flower-clusters mostly axillary and androgynous: calyx usually 3–4-cleft: fruiting bracts 1½ lines long, cuneate-obovate or fan-shaped with a narrow herbaceous coarsely (3-) toothed truncate summit, the more or less thickened and convex sides often somewhat muricate: seed scarcely half a line broad. — Proc. Am. Acad. viii. 398; Watson, l. c. 111. *Obione truncata,* Torrey; Watson, Bot. King Exp. 271.

Frequent in dry valleys from Oregon to Northwestern Nevada.

6. **A. microcarpa,** Dietrich. Minutely puberulent and slightly hoary, the numerous slender reddish branches nearly glabrous: stems ½ to 1 foot long, spreading and decumbent: leaves oblong or oblong-ovate, 3 to 5 lines long, acute at each end, sessile. flowers in small axillary clusters, the terminal ones usually more staminate: calyx deeply 5-cleft: fruiting bracts round-obovate, nearly a line broad or usually less, the rounded summit narrowly bordered with 3 to 7 small herbaceous teeth; sides frequently somewhat muricate or 1-nerved: seed ¼ line broad. — Watson, l. c. 112. *Obione microcarpa,* Benth. Bot. Sulph. 48.

Near San Diego. Specimens from the streets of San Diego (*D. Cleveland*) differ in being more farinose, the decumbent herbaceous stems (6 inches long or less) from an apparently perennial caudex; fruiting bracts larger, a line broad or more, and more herbaceously margined, 3-nerved; seed ½ line broad. They are perhaps *A. Coulteri,* Dietr.

7. **A. bracteosa,** Watson. Rather stout, suberect with spreading flexuous branches, 2 or 3 feet high, mealy: leaves thin, sessile, lanceolate, very acute or acuminate, ½ to 1 inch long, acutely sinuate-dentate or the uppermost entire: staminate flowers in dense clusters in a naked terminal simple or compound spike: calyx deeply 5-cleft: fruiting bracts in small axillary clusters, cuneate-orbicular, 1 to 1½ lines broad, the upper rounded margin irregularly gash-toothed; the sides often somewhat muricate: seed less than half a line broad. — Rev. Chenop. 115. *Obione bracteosa,* Dur. & Hilg. in Pacif. R. Rep. v. 13, t. 14.

On Pose Creek (*Heermann*), described as forming large bushes; near San Diego, *Palmer.*

8. **A. Coulteri,** Dietrich. Erect, a foot or two high, slender, virgate, rigid, branched and mealy: leaves lanceolate, attenuate at each end and mucronulate, entire, rather thick, 4 to 6 lines long, a line broad or less: fruiting bracts in axillary clusters, cuneate-orbicular, a line broad, the rounded margin reaching nearly to

the base, with short blunt teeth: seed fully a half line broad. — Watson, l. c. 113. *Obione Coulteri*, Moquin, l. c. 113.

Known only from scanty specimens in the herbarium at Kew, collected by *Coulter*, probably in Southern California: said to be perennial and fruticose. The character, as to habit and foliage, is taken from Moquin's description and may be erroneous. See under *A. microcarpa*.

A. Barclayana, Dietr. Slender, with long procumbent branches, somewhat mealy: leaves obovate and obtuse, on short petioles, or the upper oblanceolate and acutish, 8 to 12 lines long, rather thick, entire: fruiting bracts in small axillary clusters, cuneate-orbicular, a line broad, the margin above the middle rounded, coarsely and acutely toothed. — At Magdalena Bay, Lower California, *Barclay*; only imperfect specimens in the Kew herbarium.

++ ++ *Bracts orbicular, 2 to 2½ lines broad, united, surrounded by a gash-toothed herbaceous margin.*

9. **A. coronata**, Watson. Stout, erect, a foot or two high, branching and leafy, mealy: leaves lanceolate, entire, ½ to 1 inch long, acute or acuminate, attenuate to a short petiole or sessile: flower-clusters axillary, androgynous: fruiting bracts strongly compressed, the margin nearly as broad as the body, sessile or shortly pedicellate, the sides rarely slightly muricate: seed ¾ line broad. — Rev. Chenop. 114.

Near Fort Mohave (*Cooper*); San Joaquin Valley, Contra Costa County, *Brewer*.

+ + + *Fruiting bracts coriaceous, triangular-cordate, not herbaceously margined nor muricate, united to above the middle: leaves oblong-ovate, opposite, sessile.*

10. **A. decumbens**, Watson. Branching from the base, slender and decumbent or procumbent, the stems becoming somewhat woody at base, densely hoary-scurfy: leaves mostly opposite, cuneate-rounded at base, acute or acutish, ½ to 1 inch long or less: staminate flowers in dense clusters in short interrupted terminal spikes; calyx 5-cleft: fruiting bracts sessile, slightly cordate at base, acute, 2 lines long and broad, compressed, entire or slightly denticulate: seed nearly a line long. — Proc. Am. Acad. xii. 275.

Near San Diego, *Palmer*.

+ + + + *Fruiting bracts 2 to 4 lines long, indurated or spongy, rhombic-ovate, united; the sides more or less convex and usually conspicuously muricate; the margin somewhat herbaceous and toothed.*

++ *Leaves broadly obovate to ovate-oblong, alternate, entire: decumbent.*

11. **A. leucophylla**, Dietrich. Stout, densely hoary-scurfy, decumbent or procumbent: stems a foot or two long, somewhat woody near the base: leaves thick, ½ to 1½ inches long, obtuse or acutish, cuneate at base, sessile, 3-nerved: staminate flowers in dense clusters in very short terminal spikes; calyx rather large, 5-cleft: fruiting bracts in axillary clusters, sessile, 2½ to 3½ lines long, acute; the sides usually conspicuously 2-crested; the narrow margin obscurely toothed or entire: seed 1½ lines broad. — Watson, Rev. Chenop. 117. *Obione leucophylla*, Moquin, l. c. 109.

On the seashore, from San Francisco to San Diego. Described by Moquin as perennial, but probably only an annual like the last, which it much resembles in habit.

++ ++ *Leaves triangular-hastate to rhombic-ovate, the lower opposite.*

12. **A. argentea**, Nutt. Stout, erect or subdecumbent, densely mealy or scurfy, ½ to 1½ feet high, branching from the base: leaves rather thick, ½ to 2 inches long, acute or obtuse, petioled or the upper sessile: staminate flowers in dense clusters in the upper axils or in short spikes; calyx deeply 5-cleft: fruiting bracts shortly pedicellate in axillary clusters; the more or less dilated margins not reaching the base, often bifid at the summit, sharply and deeply toothed; the sides usually muricate with herbaceously tipped projections or with a double toothed crest: seed a line broad. — Watson, l. c. *Obione argentea*, Moquin.

Sierra County, *Lemmon*. Frequent in the valleys eastward to Colorado and the Upper Missouri.

13. **A. expansa,** Watson. Resembling the last, but always erect and with more widely spreading virgate branches: leaves triangular and somewhat hastate, abruptly acute, sessile or nearly so: staminate spikes usually slender and interrupted, naked above: fruiting bracts more compressed, the sides often unappendaged and strongly reticulated. — Rev. Chenop. 116.

Santa Barbara County (*Torrey*); dry river-bed near San Diego (*Palmer*); and eastward to S. Colorado and New Mexico.

* * * *Perennials, mostly dioecious and woody, densely scurfy: leaves alternate: radicle mostly superior or ascending.*

+– *Fruiting bracts with a toothed margin and the sides muricate: leaves entire.*

14. **A. polycarpa,** Watson. Erect, shrubby at base, 2 or 3 feet high, diffusely much branched; branches terete, slender, rigid and leafy: leaves thick, obovate to spatulate, 1 to 5 lines long, mostly very small and fascicled, obtuse, sessile: flowers in close panicled naked spikes: fruiting bracts somewhat orbicular, 1 to 1½ lines long, often much broader, white-scurfy and somewhat spongy, the broad margin irregularly and sharply toothed, and the sides with two or more conspicuous toothed crests: seed half a line broad. — Rev. Chenop. 117. *Obione polycarpa,* Torrey, Pacif. R. Rep. iv. 130.

San Felipe Cañon (*Palmer*); near Fort Mohave (*Cooper*), and eastward on Williams River and in the valley of the Gila, *Emory, Bigelow.*

A. Palmeri, Watson (Proc. Am. Acad. xi. 145). Stout and shrubby at base: leaves obovate or oblanceolate, rounded or acutish above, attenuate to a short petiole, ½ to 1½ inches long: fruiting bracts cuneate-orbicular, compressed, not united, 1½ lines broad, margined above the middle and irregularly gash-toothed, rarely somewhat muricate. — Guadalupe Island, *Palmer.*

A. Nuttallii, Watson (Rev. Chenop. 116. *A. canescens,* Nutt.). Erect, branching from the shrubby base: leaves oblong-spatulate to narrowly oblanceolate, ½ to 2 inches long, obtuse or acutish, narrowed to a short petiole or sessile: bracts ovate, strongly convex, united, 1½ to 2 lines long, acute or acuminate, usually more or less margined and toothed, and the sides more or less crested. — Very frequent from Northeastern Nevada to Colorado and the Saskatchewan.

+ + *Fruiting bracts small, orbicular or ovate, membranous or spongy, not margined or muricate: leaves entire.*

++ *Monœcious, procumbent and mostly herbaceous: leaves lanceolate, small, the lower opposite, sessile.*

15. **A. Californica,** Moquin. Much branched from the base, the slender leafy stems a foot long or less, densely mealy: leaves ovate- to linear-lanceolate, 3 to 8 lines long, acute at each end: flower-clusters all axillary, the upper ones more staminate: calyx deeply 4-cleft: fruiting bracts rhombic-ovate, membranous, distinct, 1½ lines long, somewhat convex: styles included: seed half a line broad: radicle inferior. — DC. Prodr. xiii². 98; Watson, l. c. 110.

Near the coast, from San Francisco Bay to San Diego.

++ ++ *Dioecious, erect and shrubby: leaves ovate to rhombic or triangular-hastate, petioled, alternate: flowers in naked axillary and terminal panicled spikes.*

16. **A. lentiformis,** Watson. Diffusely branched, 2 to 12 feet high, the branches terete with divaricate rigid occasionally somewhat spinescent branchlets, closely scurfy: leaves ovate- to oblong-rhombic or somewhat hastate, cuneate at base, ½ to 1½ inches long: flower-clusters small: calyx 5-parted: fruiting bracts orbicular, 1 or 2 lines broad, strongly compressed, united to above the middle, the free margins obscurely crenate: seed dark, ⅔ line broad. — Rev. Chenop. 118. *Obione lentiformis,* Torrey, Sitgreaves Rep. 169, t. 14.

In the desert region from Pose Creek (*Heermann*) to the southern boundary (*Palmer*), and eastward through Arizona.

17. **A. Torreyi,** Watson, l. c. Diffusely and rigidly branched, 2 to 5 feet high, strongly angled; the branchlets divaricate and spinescent: leaves triangular-ovate to -oblong or somewhat hastate, a half to an inch long, abruptly acute: calyx deeply 4-cleft: bracts orbicular to reniform, a line or two broad, distinct, strongly compressed, obscurely denticulate: seed light-colored. — *Obione Torreyi,* Watson, Bot. King Exp. 290.

East of the Sierra Nevada in the dry valleys of Nevada, and on the Mohave (*Cooper*); Southern Utah, *Palmer.*

18. **A. Breweri,** Watson. Stout, 6 feet high or more, grayish-puberulent; the branches terete, somewhat flexuous: leaves ovate-oblong, somewhat rhombic, cuneate at base, obtuse or abruptly acute, an inch or two long: calyx deeply 4-cleft: bracts spongy, ovate to rounded, convex, united at the margin to the middle, entire, 1 to 1½ lines broad. — Rev. Chenop. 119.

On the seashore at Santa Monica (*Brewer*) and Santa Barbara, *Torrey.*

+ + + *Fruiting bracts large, rounded, thick and scurfy, united at base around the seed; the dilated margins free, entire; the sides not muricate: erect densely white-scurfy shrubs.*

19. **A. confertifolia,** Watson, l. c. Diffusely branched, 1 to 5 feet high, somewhat spinescent: leaves ovate or obovate to oblanceolate, 2 to 8 lines long, obtuse or acutish, cuneate at base, shortly petioled or sessile, entire: flower-clusters small, axillary: calyx 5-cleft: bracts sessile, 2 to 6 lines long, cuneate-orbicular: seed a line broad. — *Obione confertifolia,* Torrey, Frem. Rep. 318. *O. spinosa,* Moquin, l. c. 108.

Abundant in dry valleys in the interior from N. Nevada to Utah and S. Colorado and southward to Northern Mexico.

20. **A. hymenelytra,** Watson, l. c. Diffusely branched, 2 or 3 feet high: leaves deltoid, orbicular or rhombic, ½ to 1½ inches broad, coarsely toothed, truncate or cuneate at base, on short petioles: flower-clusters paniculate-spicate: calyx 5-parted: fruiting bracts 3 to 6 lines broad, on a short thick pedicel, reniform-orbicular: seed a line broad. — *Obione hymenelytra,* Torrey, Pacif. R. Rep. iv. 129, t. 20.

In dry valleys from the Colorado eastward through Arizona and S. Utah.

+ + + + *Fruiting bracts connate and indurated, not scurfy or muricate, with four distinct broadly dilated wings, veined and entire or toothed.*

21. **A. canescens,** James. Erect and shrubby, two feet high or less: leaves oblanceolate to narrowly oblong or linear, ½ to 2 inches long, obtuse or acutish, narrowed to the base, entire: flowers mostly dicœcious, in panicled spikes: calyx 5-cleft: fruiting bracts forming a thick and indurated body 2 or 3 lines long, shortly pedicellate and with a narrow bifid apex, the 4 (rarely 8) broad lateral wings 3 to 6 lines long, overtopping the free apex and somewhat decurrent upon the pedicel: seed a line broad. — Watson, Rev. Chenop. 120. *Pterochiton occidentale,* Torrey, Frem. Rep. 318. *Obione occidentalis & Berlandieri,* Moquin, l. c. *O. tetraptera,* Benth. Bot. Sulph. 48.

A very frequent species in the interior, from Northern Nevada and Colorado to Northern Mexico and S. California; San Bernardino to San Diego and eastward.

8. EUROTIA, Adanson.

Flowers dicœcious or monœcious. Staminate flowers without bracts: calyx 4-parted: stamens as many, with slender exserted filaments. Pistillate flowers bibracteate, without perianth. Bracts sessile, obcompressed, united, becoming

enlarged and membranaceous, densely hairy, not winged or appendaged. Styles 2, somewhat hairy, exserted. Fruit oblong-ovate, sessile, the pericarp membranous and rather firm, pubescent. Seed vertical, obovate, with simple membranous testa. Cotyledons broad and green: radicle inferior. — Low stellately tomentose undershrubs; leaves alternate, entire; flowers in small axillary and somewhat spicate clusters.

Only two other species are known, belonging to Asia and Southern Europe.

1. **E. lanata,** Moquin. White-tomentose throughout (becoming rufous), a span or two high, woody below, with strict ascending leafy branches: leaves linear to narrowly lanceolate, obtuse, ½ to 1½ inches long, margins revolute: calyx-lobes ovate, acute, hairy: fruiting bracts lanceolate, 2 or 3 lines long, nearly covered by 4 dense spreading tufts of long silvery-white hairs, and beaked above with two short erect horns: utricle filling the cavity and loosely enveloping the seed, which is 1½ lines long. — DC. Prodr. xiii². 121; Watson, Rev. Chenop. 121.

In subalkaline soils eastward of the Sierra Nevada from Oregon to the Saskatchewan, and southward to Nevada and New Mexico. Abundant in some valleys and valuable as a winter forage plant; usually known as "White Sage," or "Winter Fat," and of good repute as a remedy for intermittents.

9. GRAYIA, Hook. & Arn.

Flowers dioecious or sometimes monœcious. Staminate flowers without bracts: calyx mostly 4-parted: stamens 4 or 5, with short subulate filaments. Pistillate flowers bibracteate, without perianth. Bracts membranous, strongly obcompressed and united into an orbicular sac with a small naked orifice at the apex, enlarged in fruit, net-veined and wing-margined. Styles 2. Pericarp thin and membranous. Seed vertical, orbicular, with thin membranous testa. Radicle inferior. — Slightly scurfy or mealy undershrubs; leaves alternate, entire; flowers small, in axillary clusters or terminal spikes. Only the following species.

1. **G. polygaloides,** Hook. & Arn. Erect, diffusely branched, 1 to 3 feet high, the branches frequently spinescent: leaves glabrous or at first with the young branches somewhat mealy, rather fleshy, oblanceolate or spatulate to obovate, 6 to 15 lines long, obtuse or acute, narrowed at base and sometimes petioled: staminate flowers in axillary clusters; the pistillate mostly spicate: fruiting bracts 3 to 6 lines in diameter, sessile, glabrous, emarginate, thin, white or pinkish, adherent below to the pedicel of the ovary: styles slender, at first exserted: seed nearly central, about ⅔ line broad. — Bot. Beechey, 387; Hook. Icones, t. 271; Watson, Rev. Chenop. 122. *G. spinosa,* Moquin, l. c. 119.

Frequent in alkaline soils eastward of the Sierra Nevada from the Columbia River to Wyoming, Utah and Southeastern California.

G. Brandegei, Gray, Proc. Am. Acad. xi. 101, of S. W. Colorado, is lower and unarmed, more mealy, with linear-spatulate leaves; fruit smaller (3 lines broad), slightly mealy, retuse at base, sometimes 3-winged; wings somewhat undulate; ovary sessile; style short, included.

10. CORISPERMUM, Ant. Jussieu. Bug-seed.

Flowers perfect, without bracts. Perianth of a single hyaline ovate or rounded sepal, erose or lacerate at the apex (rarely of 2 or 3), sometimes wanting. Stamens 1 to 5, unequal. Styles 2, slender. Fruit vertical, compressed, plano- or concavo-convex, elliptic, the margin acute or narrowly winged; pericarp membranous, closely adherent to the seed. Embryo green, slender, surrounding the copious somewhat

fleshy albumen : radicle inferior. — Low branching pale-green annuals ; leaves alternate, sessile, mostly narrow ; flowers spicate, solitary in the axils of reduced bracts.

A genus of 8 or 10 species, of Eastern Europe and Central Asia, a single species also American.

1. **C. hyssopifolium,** Linn. Somewhat floccose- or villous-pubescent, at least when young, ½ to 1½ feet high, erect, rather rigid : leaves linear, ¾ to 1½ inches long, cuspidate ; the floral bracts from linear-lanceolate to ovate, membranously margined : spikes short and close, becoming more or less elongated : central stamen longest, the lateral ones partially developed or wanting : fruit broadly elliptical, 1½ or 2 lines long, narrowly winged, obtuse, often mucronate with the persistent styles.

A variable species of wide range, found from Point Barrows and the mouth of the Mackenzie to the Columbia and N. Illinois, and southward through the interior to Chihuahua and New Mexico ; not differing from Old World forms.

11. SALICORNIA, Tourn. Glasswort. Samphire.

Flowers mostly perfect, deeply sunk by threes in the rhachis of the jointed spike, in the axils of cup-shaped decussately opposite bracts, the lateral ones of each cluster lower and often only staminate. Calyx a fleshy rhomboidal sac with an anterior opening (or formed by two bracts united above and below), enclosing the flower and fruit, adherent by a narrow line to the rhachis, at length thickened and spongy and finally deciduous. Stamens 1 or 2, with large oblong anthers on short filaments, exserted in flower. Styles 2 or 3, short. Pericarp membranous, adherent to the vertical obovate-oblong seed. Albumen very small, lateral : embryo folded, thick, green : radicle inferior. — Low fleshy leafless saline plants, mostly herbaceous, with oppositely branched jointed stems ; spikes cylindrical.

Eight species or more are recognized, distributed over most sea-coasts excepting on the Asiatic side of the Pacific, and in saline localities. The specific characters are obscure, especially in dried specimens, and the species are not easily defined.

1. **S. ambigua,** Michx. Perennial and somewhat woody at base, the stems decumbent and rooting at the joints or ascending, a half to a foot long or more, with slender mostly simple branches : spikes slender (usually narrower than the stem), ½ to 1 inch long, short-jointed, with short acute or acutish bracts : flowers nearly equal in height and in fruit nearly equalling the joint : seed pubescent, ⅓ line long. — Watson, Rev. Chenop. 125. *Arthrocnemum ambiguum* & *A. fruticosum*, var. *Californicum*, Moquin in DC. Prodr. xiii². 151. *S. fruticosa*, var. *ambigua*, Gray, Manual, 410.

On the sea-coast from Oregon to San Francisco, and on the Atlantic side from New England to Florida ; resembling *S. fruticosa* of the Old World.

S. HERBACEA, Linn. A low annual, erect, branching, with longer jointed spikes ; the middle flower twice higher than the lateral ones. — It is reported as collected in Oregon, and occurs in saline localities in the interior and on the eastern coast ; may be found in N. E. California.

12. SPIROSTACHYS, Ungern-Sternberg.

Flowers perfect, densely spiked, by threes in the axils of spirally ranked fleshy sessile bracts. Perianth of 4 (rarely 5) concave carinate sepals, imbricated and more or less united, becoming somewhat spongy and covering the fruit. Stamens 1 or 2 : filaments slender, at length exserted. Styles 2, rarely 3, usually distinct. Fruit oblong, with membranous free pericarp. Seed vertical, oblong, with double membranous testa. Embryo green, nearly surrounding the rather copious albumen : radicle inferior : cotyledons short. — Saline shrubs, with alternate naked branches,

the branchlets green and fleshy, jointed, with short scale-like leaves. — Syst. Salic. 100. *Heterostachys*, Ung.-Sternb. in Att. Cong. Intern. Bot. 1876.

The genus was founded upon the one other species, *S. Ritteriana* of South America and the West Indies. The generic name has recently been changed by the author to *Heterostachys*, but upon hardly sufficient grounds.

1. **S. occidentalis**, Watson. Erect, diffusely branched, 2 to 5 feet high: scale-like leaves broadly triangular and acute, amplexicaul, often nearly obsolete: spikes numerous, sessile or nearly so, cylindrical, 3 to 10 lines long, densely flowered; bracts rhomboidal, crowded, persistent: flowers slightly exserted, at length deciduous: seed less than ¼ line long. — Rev. Chenop. 125. *Arthrocnemum macrostachyum*, Torrey, Bot. Mex. Bound. 184. *Halostachys occidentalis*, Watson, Bot. King Exp. 293.

Confined to strongly alkaline or saline localities; frequent in the Great Basin from Northern Nevada to Arizona and Western Texas; in the San Joaquin Valley, near the Sacramento, *Brewer*.

13. SUÆDA, Forskal. Sea Blite.

Flowers perfect or rarely polygamous, minutely bracteolate. Calyx 5-cleft or -parted, fleshy; the lobes unappendaged or more or less strongly carinate or crested or at length somewhat winged, enclosing the fruit. Stamens 5. Styles 2, rarely 3 or 4, short and rather thick. Pericarp membranous, free or slightly adherent to the vertical or horizontal lenticular seed. Testa shining, black and crustaceous. Embryo spiral, the radicle exterior. Albumen lateral and scanty or wanting. — Saline herbs or shrubs; leaves alternate, fleshy, subterete; flowers axillary along the branches, clustered or solitary, sessile. — *Chenopodina*, Moquin. *Schoberia*, C. A. Meyer.

A widely distributed genus of perhaps 30 or more species. On account of their succulent nature the plants are much changed by drying and the specific differences obscured. Besides the following, two or three other species are found on the Atlantic Coast and in the interior.

* *Annuals.*

1. **S. diffusa**, Watson. Erect, 1 to 1½ feet high, diffusely branched with usually elongated slender flexuous branches, smooth or more or less pubescent, the whole plant green or purple: leaves linear, semiterete, narrow at base, acute or acuminate, a half to an inch long, the floral ones similar but shorter, usually rather distant on the branches: clusters 2 – 4-flowered: calyx cleft to below the middle, not carinate or appendaged: seeds mostly vertical, half a line broad, very smooth. — Rev. Chenop. 88. *S. maritima*, Watson, Bot. King Exp. 294.

Common in the alkaline valleys of the interior, from N. E. California to the Upper Missouri, and southward to Northern Mexico and the Rio Grande.

2. **S. depressa**, Watson. Low and mostly decumbent, branching from the base, with usually short ascending leafy branchlets: leaves linear, broadest at base, semiterete, ¼ to 1 inch long, the floral ones oblong- to ovate-lanceolate or ovate, acute, rather crowded: calyx cleft to the middle somewhat unequally, one or more of the acute lobes strongly carinate or crested: seed vertical or horizontal, half a line broad, very lightly reticulated. — Bot. King Exp. 294; Rev. Chenop. 89. *Salsola depressa*, Pursh.

Var. **erecta**, Watson. Erect, a foot or two high, with very narrow leaves and narrower bracts. — Rev. Chenop. 90.

From the Sierra Nevada eastward to the Saskatchewan and Colorado; near Fort Tejon, *Blake*.

S. occidentalis, Watson, l. c., is a similar little known species of N. E. Nevada, erect and slender, with flexuous spreading branches; leaves linear, narrow at base; perianth at length surrounded by a transverse irregularly lobed wing.

* * *Woody-based perennials.*

3. **S. Californica,** Watson. Stout, 2 or 3 feet high, with herbaceous ascending very leafy branches, smooth or somewhat pubescent: leaves broadly linear, not wider at base, a half to an inch long, acute, crowded upon the branchlets: flowers large, 1 to 3 or more in the axils; perianth cleft nearly to the base, the lobes not appendaged: seeds vertical or horizontal, nearly a line broad, faintly reticulated. — Rev. Chenop. 89.

In salt-marshes on the coast, about San Francisco.

4. **S. Torreyana,** Watson. Erect, 2 or 3 feet high, with herbaceous leafy branches, smooth or tomentose: leaves linear, subterete, narrow at base, ½ to 1½ inches long, mostly acute, the floral ones similar: clusters several-flowered: perianth rather large, deeply cleft: seed vertical, ¾ line broad, finely tuberculate. — Rev. Chenop. 88. *Chenopodina Moquini,* Torrey, Pacif. R. Rep. vii. 18.

Santa Barbara to San Diego and eastward, and through the interior from Northern Nevada to Colorado and Northern Mexico. Resembling *S. fruticosa* of the Old World.

5. **S. suffrutescens,** Watson, l. c. Shrubby or somewhat so, 2 or 3 feet high, with slender diffuse or divaricate leafy branches, which are more or less tomentose: leaves numerous, mostly small, half an inch long or less, linear to narrowly oblong, narrow at base, obtuse or acute: flowers solitary or clustered, small, shortly lobed: seed mostly vertical, less than ½ line broad, very obscurely tuberculate.

In alkaline valleys from Southern California to the Rio Grande.

14. SARCOBATUS, Nees. Grease-wood.

Flowers monœcious or diœcious, without bracts, dimorphous. Staminate flowers in terminal aments, without perianth: stamens 2 to 5, irregularly arranged under a stipitate peltate scale; filaments very short; anthers fleshy. Pistillate flowers axillary, solitary or rarely clustered. Perianth a compressed ovate sac, adherent at the contracted somewhat 2-lipped apex to the base of the stigmas, laterally margined by a narrow erect slightly 2-lobed border, which becomes at length a broad circular horizontal membranous veined wing. Ovary thin and hyaline, nearly filled by the ovule. Style lateral, slender, adherent to the perianth, and terminated by two thick exserted unequal stigmas. Seed vertical, with a double transparent membranous testa. Embryo spiral, green, without albumen: radicle inferior. — A rigidly and divaricately branched somewhat spinescent shrub, of saline localities; leaves fleshy, alternate, linear. — Pl. Neuwied, 20. *Fremontia,* Torrey.

1. **S. vermiculatus,** Torrey. Erect and scraggy, 2 to 8 feet high, leafy, glabrous or the young twigs grayish puberulent; branches with a smooth white bark, spiny or spinescent: leaves ½ to 1½ inches long, a line or two wide, narrow at base: staminate spikes terminal, cylindrical, ½ to 1 inch long, narrow; the persistent scales spirally arranged, rhombic-ovate, acute: stamens about 3, soon deciduous: fruiting calyx coriaceous, 2 or 3 lines long, the wing 3 to 6 lines broad: pericarp distinguishable with difficulty: seed half a line in diameter. — Emory's Rep. 149; Watson, Rev. Chenop. 86; Engelm. in Simpson's Rep. 445. *Batis (?) vermiculata,* Hook. Fl. Bor.-Am. ii. 128. *Sarcobatus Maximiliani,* Nees; Seubert, Bot. Zeit. ii. 753, t. 7. *Fremontia vermicularis,* Torrey, Frem. Rep. 95 & 317, t. 3.

Frequent in the alkaline valleys of the Great Basin, from the Sierra Nevada eastward to the Upper Missouri and the headwaters of the Platte and Canadian, and southward to the Gila; the most prevalent of the several shrubs bearing the name of "Grease-wood." The wood is very compact and hard, of a light yellow color, but the stems rarely exceed 2 or 3 inches in diameter, and are usually knotted and twisted; the bush, however, though small is valuable for fuel, and often the only resource.

Order LXXX. BATIDEÆ.

Formed for a single genus and species of wholly doubtful affinity, a fleshy maritime shrub, which from its aspect rather than its characters is here placed next the *Chenopodiaceæ*, its true relationship being undetermined.

1. BATIS, P. Browne.

Flowers diœcious, bracteate, in oblong axillary sessile ament-like spikes. Staminate flowers free, with a campanulate 2-lipped calyx. Stamens 4, alternate with as many unguiculate petals. Pistillate flowers 8 to 12, united into a fleshy spike, without perianth. Ovaries coherent (becoming a fleshy ovoid-conical fruit), 4-celled, with a single erect anatropous ovule in each cell: stigma sessile, thick and capitate. Seed with a membranous testa and no albumen, erect, oblong. Embryo slightly curved; radicle inferior, very small. — A low seaside shrub, with opposite entire fleshy leaves, without stipules.

1. **B. maritima**, Linn. Glabrous: stems branched and straggling, 3 or 4 feet long, usually prostrate: leaves linear to obovate-oblong, an inch long, narrowed to the base: spikes solitary in the axils along the branches; the staminate 2 to 4 lines long, 12 – 20-flowered; the pistillate a line long, becoming 6 to 8 lines in fruit: bracts obtuse or acute, entire, in 4 vertical rows, of the male spikes imbricate and persistent, of the female deciduous: petals white, with rhomboidal limb: stamens exserted: fruit with spongy pericarp and tough and coriaceous endocarp, the seed a line long or less. — Torrey, Smithson. Contrib. 1853, t. 11; A. DC. Prodr. xvii. 35; Baill. Dict. Bot. 1. 382, figs.

Collected only near San Diego (*Parry*), but frequent in the West Indies and on the neighboring mainland (Tampa Bay, Florida), and also found in the Sandwich Islands. With the habit of the *Chenopodiaceæ*, but differing widely in some of its characters.

Order LXXXI. LAURACEÆ.

Aromatic trees and shrubs, completely distinguished by the minutely punctate alternate simple leaves, always with entire (i. e. not serrate) margins, no stipules, a perianth of 4 or 6 sepals more or less imbricated in two series in the bud, anthers opening by one or two uplifted valves to each cell, a single style and stigma, and a 1-celled free ovary which contains a solitary suspended anatropous ovule and becomes a drupaceous or baccate fruit. Embryo filling the seed, with large planoconvex cotyledons and a short included radicle. Flowers either perfect or diœcious, mostly in cymes or clusters, small; the perianth usually colored (white or yellowish). Stamens definite or somewhat indefinite, in 3 or 4 series, some of them not rarely sterile; the inner ones often 2-glandular at base and with extrorse anthers. (*Cassytha*, a tropical genus, is leafless, scentless, and parasitic-climbing in the manner of *Cuscuta*.)

A large order of 50 genera and 900 species, chiefly of the tropical regions of Asia and America, and yielding valuable timbers and other products. It includes various Cinnamon, Cassia, and Camphor trees, the Laurel or Sweet Bay, and the Sassafras. Seven species of five genera are found in the Atlantic States, but the only representative on the Western Coast is the following, belonging in the principal suborder *Laurineæ* to the tribe *Litsaneæ*, having the umbels or clusters of flowers included before expansion in a 4 – 6-leaved caducous involucre.

1. UMBELLULARIA, Nutt. Mountain Laurel. Spice-Tree.

Flowers perfect, in pedunculate umbels which are included before expansion in involucres consisting of 4 broad caducous bracts: calyx deciduous, 6-parted: stamens 9, inserted on the throat in 3 rows, the 3 inner with a fleshy 2-lobed stipitate gland on each side of the base, alternating with 3 ligulate staminodia; anthers 4-celled, 4-valved, the outer introrse, the inner extrorse: stigma dilated, somewhat lobed: drupe subglobose, subtended by the thickened base of the calyx. — Arborescent, with alternate petioled thick and evergreen leaves, very odoriferous: inflorescence terminal or axillary. A single species. — Benth. & Hook. Gen. Pl. iii. 162.

1. **U. Californica,** Nutt. A handsome shrub or tree, 10 to 70 feet high or more, the young branches, petioles, and inflorescence somewhat puberulent: leaves green and shining, lanceolate-oblong, acute at each end or sometimes rounded at base, 2 to 4 inches long, short-petioled: peduncles in an apparently terminal panicle or solitary in the upper axils, 6 to 12 lines long, 6–10-flowered; involucral bracts ovate, imbricated; pedicels 1 to 5 lines long, usually bracteate at base: sepals yellowish green, 1½ to 2½ lines long, oblong to ovate; stamens included: drupes on short stout axillary or terminal peduncles, solitary or 2 or 3 together, ovate-elliptical or globose, nearly an inch long, becoming dark purple with thin pulp and stone. — Sylva, i. 87. *Laurus regia,* Dougl. Comp. Bot. Mag. ii. 127. *Tetranthera Californica,* Hook. & Arn. Bot. Beechey, 159. Meissner, DC. Prodr. xv[1]. 193; Newberry, Pacif. R. Rep. vi. 24, fig. 3. *Oreodaphne Californica,* Nees, Syst. Laur. 463; Hook. Bot. Mag. t. 5320. *Drimophyllum pauciflorum,* Nutt. Sylva, i. 85, t. 22.

From Douglas County, Oregon (*Douglas*), to San Diego, flowering in March and April, the fruit ripening in July and persistent until the next year. In the more southern localities and in the Sierra Nevada it rarely exceeds 10 or 20 feet in height, but northward it becomes a large tree 4 to 6 feet in diameter and 100 feet high or more, the timber very handsome and valuable, much used for ornamental wainscoting and furnishing. The foliage is exceedingly acrid, exhaling when bruised a very pungent aromatic effluvium which excites sneezing. The tree is known by various names, as California Olive, California Laurel, Cajeput, etc. The inflorescence is at first apparently terminal but usually becomes axillary by the prolongation of the branch. Few of the flowers set fruit, rarely more than one or two in a cluster.

Order LXXXII. THYMELEACEÆ.

Shrubs or small trees, distinguished by a very tough fibrous inner bark, perfect flowers, a gamosepalous petaloid perianth bearing on its tube usually twice as many stamens as there are lobes, introrse anthers dehiscing longitudinally, and a pistil of a single carpel, the ovary usually containing a single anatropous ovule suspended from the summit of the cell. Fruit usually a berry: embryo filling the seed, with plano-convex cotyledons. — Flowers axillary or terminal, often fascicled.

An order of nearly 40 genera and over 300 species, largely of the warm extra-tropical regions of Africa and Australia, remarkable for the toughness of the bark and burning acridity of the juice. Various species have furnished material for cordage and paper, and others have been employed for medicinal purposes or for dyeing; some, as *Daphne Mezereum,* are cultivated for ornament. The following is the only North American genus.

1. DIRCA, Linn. Leatherwood.

Flowers perfect: perianth light-yellow, glabrous, tubular-funnelform, the limb obliquely truncate, 4-lobed or repandly toothed. Stamens 8, attached near the

middle of the tube, exserted, the alternate ones shorter. Ovary glabrous: style filiform, nearly terminal, exceeding the stamens: ovule solitary. Drupe oval; naked, reddish. — Much branched shrubs, with short-jointed branchlets; leaves alternate, deciduous, oval-obovate, on very short petioles, the bases covering the buds of the next year; flowers in axillary clusters of 3 or 4, involucrate with as many densely hairy scales and preceding the leafy branchlets. Only two species.

1. **D. occidentalis,** Gray. A diffuse shrub 3 or 4 feet high: leaves obovate to oval, 1 to 2½ inches long, rounded or cuneate at base, obtuse or acutish, with the branchlets somewhat villous, becoming glabrous: scales of the involucre white-villous, 3 to 5 lines long: flowers nearly sessile, 3 or 4 lines long, rather deeply 3–4-lobed, the rounded slightly spreading lobes a line long: stamens inserted below the middle of the tube. — Proc. Am. Acad. viii. 631. *D. palustris,* Torrey, Pacif. R. Rep. iv. 133.

Frequent in ravines on the eastern slope of the Oakland Hills, flowering in April; the mature fruit has not been collected. It differs from *D. palustris,* Linn., of the Atlantic region, mainly in the deeper calyx-lobes, lower insertion of the stamens, sessile flowers, and whiter involucre.

Order LXXXIII. ELÆAGNACEÆ.

Shrubs or small trees, without tough bark, the foliage scurfy throughout with scarious silvery or brown scales, with regular flowers mostly dioecious, the perianth herbaceous or colored within, its tube lined with a prominent disk bearing the stamens, enclosing the 1-celled ovary, and becoming pulpy or spongy without and bony within; style terminal; fruit a membranous akene, closely covered by the drupe-like calyx-tube, and the seed erect, with scanty albumen; radicle inferior and cotyledons narrower: otherwise nearly as the last order. Flowers solitary or variously clustered in the axils of the branchlets.

A small order of 4 genera and about 30 species, chiefly of tropical or subtropical Asia; only 4 species of 2 genera are North American. The second genus, *Elæagnus,* of the Rocky Mountains and eastward, is distinguished by having perfect flowers with only 4 stamens.

1. SHEPHERDIA, Nutt. Buffalo-Berry.

Flowers dioecious. Staminate perianth 4-parted, the lobes spreading, valvate in the globular bud. Stamens 8, alternate with as many lobes of a thick disk; filaments free, shorter than the limb. Pistillate flowers with oblong-tubular perianth; limb 4-cleft, erect, and the throat closed by the lobes of the disk. Style persistent; stigma lateral. Fruit berry-like, with a smooth shining compressed seed. — Leaves opposite, deciduous; flowers small (the staminate larger), shortly pedicellate. Only the following species.

1. **S. argentea,** Nutt. A somewhat spiny shrub, 5 to 18 feet high: leaves silvery on both sides, mostly oblong, obtuse, cuneate at base, 1 to 1½ inches long: staminate flowers 1½ lines long, the pistillate 1 line: fruit a smooth ovoid scarlet berry, 2½ lines long, acid and edible, nearly sessile. — Genera, ii. 240. *S. elæagnoides,* Nutt. in Proc. Acad. Philad. vii. 50.

East of the Sierra Nevada, from Mono Lake northward to British America and the Saskatchewan, and in the mountains south to New Mexico. Flowers forming and sometimes opening in the autumn: fruit ripening in July, often abundant.

S. CANADENSIS, Nutt., a low shrub with rusty scurf, elliptical or ovate leaves, and yellowish-red insipid fruit, ranges from the Columbia River across the continent, and in the Rocky Mountains southward to New Mexico. It may be found in the mountains of N. California. The only other species, S. ROTUNDIFOLIA, Parry, with small crowded rounded leaves and scurfy fruit, is peculiar to the mountains of S. Utah.

ORDER LXXXIV. URTICACEÆ.

Herbs (our species), with watery juice and thin tough fibrous bark, petioled stipulate leaves, and often armed with stinging hairs; flowers monœcious or diœcious, usually green, the perianth 3–5-parted or -lobed, with as many stamens opposite the lobes, filaments inflexed in the bud and straightening elastically; ovary simple, free, ovoid, with an erect orthotropous ovule, becoming an akene or drupe in fruit; style or stigma simple, the latter often tufted; seed albuminous, with straight axile embryo and superior radicle. Flowers usually in racemed or panicled cymes, with small persistent bracts.

Mainly a tropical or subtropical order, of over 40 genera and 400 species, the following genera being the only ones that are largely represented in temperate regions. The value of the order lies in the great toughness of the cortical fibre, which in the Remie or China Grass (*Bœhmeria nivea*) is also remarkably white and silky. The following orders, which appear to have no indigenous representatives in the Californian flora, are by some authorities considered as suborders of *Urticaceæ*.

The CANNABACEÆ, which include the Hemp (*Cannabis sativa*, Linn.) and Hop (*Humulus Lupulus*, Linn.), are distinguished by the fertile calyx of a single scale-like sepal, 2 styles, a pendulous seed without albumen, and the embryo hooked or coiled. Hemp is an erect tall annual, with digitate leaves, a native of Asia and found elsewhere frequently as an escape from cultivation. The Hop, a twining herbaceous perennial with palmately lobed leaves, a native of Europe and N. Asia, and extensively cultivated, is indigenous in the mountains from British America to New Mexico, but has not been found in California.

The ULMACEÆ and CELTIDACEÆ include trees or shrubs with fugacious stipules, straight filaments, 2 styles, and a suspended seed; the former having perfect flowers, extrorse anthers and a winged or crested fruit; the latter polygamous flowers, introrse anthers, and the fruit a drupe. The *Ulmaceæ* are represented in America by the Elms and Planera, which are confined to the Atlantic States; the *Celtidaceæ* by several species of the genus *Celtis* or Hackberry, some of which approach the borders of the State. — C. RETICULATA, Torrey. Somewhat pubescent with short spreading hairs; leaves thick, very rough and strongly reticulated, 2 to 4 inches long, obliquely ovate, cordate at base and shortly acuminate, sharply serrate or sometimes partially entire; fruit 3 lines or more in diameter, on slender pedicels 5 to 7 lines long. Of New Mexico and Texas, Oregon (*C. Douglasii*, Planch.), and apparently also from the Cerros Islands of Lower California, *Veitch.* — C. BREVIPES, Watson. Slightly pubescent; leaves rather thin, minutely scabrous above, prominently reticulated beneath, 12 to 18 lines long, obliquely ovate-oblong, acuminate, rounded or shortly cuneate at base, entire; fruit nearly 3 lines long, on slender pedicels 2 lines long, about equalling the very slender petioles. Near Camp Grant, S. E. Arizona, *Dr. J. T. Rothrock* (n. 367) on Lieut. Wheeler's Expedition, 1874; described as a tree 20 feet high and 18 inches in diameter, with light-colored bark. — Another form, referred to *C. occidentalis*, var. *pumila*, in Bot. King Exp. 321, but probably distinct, ranges from Idaho to E. Nevada and S. Utah.

The MORACEÆ are another closely allied order of trees or shrubs, with milky juice, fugacious stipules, minute monœcious or diœcious flowers in close spikes or heads or often on an open or closed receptacle, becoming fleshy in fruit. To this very important order belong the Fig (*Ficus*), which includes the Banyan and many India-rubber trees, the Poison Upas (*Antiaris toxicaria*), the Mulberry (*Morus*), the Paper Mulberry (*Broussonetia papyrifera*), the Osage Orange (*Maclura aurantiaca*), the Breadfruit, and numerous others yielding various useful products. Scarcely half a dozen species are natives of North America; only the following approaches the borders of California. — MORUS MICROPHYLLA, Buckley, Proc. Acad. Philad. 1862, 8. A small tree 15 to 20 feet high; leaves more or less pubescent, at length scabrous, ovate, often somewhat cordate at base, acuminate, serrate, sometimes lobed, usually an inch or two long; staminate aments less than half an inch long; fruit small, black and sour. Frequent in Texas and ranging west to Prescott, Arizona, *Palmer.*

* Beset with stinging hairs : leaves opposite, dentate, stipulate : akene compressed.

1. **Urtica.** Sepals 4, distinct, the inner ones largest in the fertile flowers and enclosing the akene.
2. **Hesperocnide.** Staminate calyx 4-parted; pistillate tubular, unequally 2–4-toothed and enclosing the akene.

* * Unarmed : leaves alternate, entire, without stipules : akene ovoid.

3. **Parietaria.** Inflorescence involucrate-bracted. Staminate calyx 4-parted; pistillate tubular-campanulate, 4-lobed, enclosing the akene.

1. URTICA, Tourn. NETTLE.

Flowers monœcious or diœcious, green, clustered in axillary geminate racemes, spikes or loose heads, without bracts : staminate flowers on jointed pedicels, with 4 sepals, 4 stamens, and a rudimentary cup-shaped ovary; the pistillate with 4 sepals, the 2 outer small and spreading, the inner erect, becoming membranous and enclosing the flattened ovate akene : stigma sessile, capitate, tufted : albumen scanty. — Herbs, armed with stinging hairs, with obtusely 4-angled sulcate stems; leaves opposite, serrate, with distinct lateral stipules; fruit persistent.

A wide-spread genus in temperate and subtemperate regions, of 30 or 40 species, about a third American.

* *Perennials, with running rootstocks : inflorescence unisexual; panicles usually exceeding the petioles: stipules large, entire.*

1. **U. holosericea,** Nutt. Tall and stout, 5 to 8 feet high, more or less bristly, finely and densely tomentose especially on the lower side of the leaves : stipules membranous, ½ inch long, oblong, obtuse or acute; leaves thick, oblong- to ovate-lanceolate, acuminate, 2 to 4 inches long, rounded or subcordate at base, coarsely serrate, on short stout petioles : staminate flowers in loose slender diffuse panicles nearly equalling the leaves; pistillate panicles denser and shorter : inner sepals ovate, densely hispid, ½ line long, about equalling the broadly ovate akene. — Pl. Gambel. 183; Watson, Proc. Am. Acad. x. 349. *U. trachycarpa,* Weddell, Monogr. 95, & DC. Prodr. xvi¹. 58. *U. dioica,* var. *occidentalis,* Watson, Bot. King Exp. 321.

Throughout the State, and eastward to Utah; especially common in S. California. Nuttall describes the leaves as sometimes (probably the lowest ones) a span long and long-petioled.

2. **U. Breweri,** Watson. Tall and stout, grayish with a short somewhat hispid pubescence or nearly glabrous, and with scattered bristles : stipules membranous, oblong-lanceolate : leaves thin, finely pubescent, soon glabrate or roughish above, ovate to oblong-lanceolate, 2 to 6 inches long, acute or acuminate, rounded or slightly cordate at base, coarsely serrate, on slender petioles 1 to 3 inches long or more : flowers in short open panicles scarcely exceeding the petioles : sepals obovate or rounded, obtuse, minutely hispid, nearly a line long and nearly twice longer than the broadly ovate akene. — Proc. Am. Acad. x. 348; Rothrock, Bot. Wheeler, t. 25.

Frequent about Los Angeles (*Brewer*) and ranging eastward to S. Colorado (*Wolf*) and W. Texas, *Bigelow.*

3. **U. Lyallii,** Watson, l. c. Tall, rather slender, more or less pubescent, becoming nearly glabrous, with scattered bristles : stipules large, membranous, broadly oblong, obtuse; leaves ovate, somewhat cordate at base, acute, 3 to 6 inches long or more, coarsely serrate, on slender petioles 2 to 4 inches long : flowers in loose slender spreading panicles, equalling or shorter than the petioles : sepals broadly ovate or rounded, obtuse, shorter than the broadly ovate akene, which is ⅔ line long.

A very large-leaved species, collected in Marin County (*Kellogg*) and northward in the Cascade Mountains and at Vancouver Island, *Lyall.*

* * *Annuals: inflorescence of mingled male and female flowers, usually shorter than the petioles: stipules very small.*

4. **U. urens,** Linn. Slender, erect or ascending, a foot or two high, with short lateral branchlets, leafy throughout, with scattered hairs or nearly glabrous: leaves thin, ovate or ovate-oblong, an inch or two long, coarsely and incisely toothed; stipules small, free: flower-clusters mainly pistillate, rather close and nearly sessile or more loosely panicled: fruiting sepals ovate, hispid on the margin, usually with a single lateral bristle: akene a line long.

An introduced weed from Europe.

2. HESPEROCNIDE, Torrey.

Distinguished from the last group under *Urtica* only by the pistillate perianth, which is a membranous compressed oblong-ovate sac, with a minutely 2–4-toothed orifice. — Annual herbs; only two species, the second belonging to the Sandwich Islands.

1. **H. tenella,** Torrey. Slender and weak, often a foot or two high, simple or branched, somewhat hispid with branching hairs and bristly: leaves thin, ovate, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, on short slender petioles, obtusely serrate: flower-clusters loose, shorter than the petioles: perianth thin, hispid with hooked hairs, $\frac{1}{2}$ to $\frac{3}{4}$ line long in fruit: akene membranous, striately tuberculate with minute rough points. — Pacif. R. Rep. iv. 139; Weddell, DC. Prodr. xvi[1]. 68.

In the shade of rocks, Napa County and southward; Guadalupe Island, *Palmer*.

3. PARIETARIA, Tourn. Pellitory.

Flowers perfect and pistillate, in axillary cymose clusters, involucrate-bracted: perianth in the perfect flowers 4-parted, in the pistillate tubular-ventricose and 4-cleft with connivent lobes: style slender or none: stigma spatulate, recurved, densely tufted: akene ovoid, shining, enclosed in the dry brownish nerved calyx: albumen scanty. — Low annuals (our species), unarmed; leaves alternate, entire, 3-nerved, without stipules.

A widely distributed genus of 8 or 10 species, two of them American.

1. **P. debilis,** Forster. Very slender, 3 to 12 inches high, usually diffusely branching from the base, somewhat hispid: leaves small, broadly ovate, obtuse, rounded at base or abruptly cuneate, 2 to 6 lines long or more, about equalling the slender petioles: clusters few-flowered; bracts linear or narrowly oblong, short ($\frac{1}{2}$ to 1 line long), about equalling the flowers: akene $\frac{1}{2}$ line long. — Weddell, DC. Prodr. xvi[1]. 235[45].

Southern California, from Santa Barbara to San Diego, and eastward in various forms across the continent, southward to Chili, and nearly everywhere within a like broad zone around the globe.

P. Pennsylvanica, Muhl., is a more northern species, common in the Atlantic States and collected as far west as the mountains of N. E. Nevada. The leaves are lanceolate, more attenuate at base, and often 2 inches long or more; bracts longer and exceeding the flowers; akene somewhat larger.

Order LXXXV. PLATANACEÆ.

Monœcious trees, with flaky bark, alternate palmately nerved and lobed leaves, with sheathing deciduous stipules, and the hollowed petiole covering the bud;

flowers in dense globose naked unisexual heads, without perianth, mingled with clavate truncate and minute hairy scales; akenes obpyramidal, coriaceous, 1-celled and 1-seeded, surrounded at base by a dense ring of long hairs; seed pendulous, orthotropous. Staminate and pistillate heads on different branches, the latter terminal, solitary or few and moniliform-spicate. Filaments very short: anthers clavate, with a prolonged peltate connective. Ovaries in clusters on a globular fleshy receptacle: style terminal, stigmatic on one side, persistent: ovules 1 (rarely 2), pendulous. Seed with membranous testa and little or no albumen. Radicle elongated, inferior.

A single genus of half a dozen species, one in the orient of the Old World, the rest North American and Mexican.

1. PLATANUS, Tourn. Buttonwood. Sycamore.

Characters as of the order.

1. **P. racemosa,** Nutt. A widely branched tree, rarely becoming 100 feet high and 6 feet or more in diameter: leaves very variable, densely tomentose when young with pale or rusty tomentum, which is mostly deciduous, usually very broadly cordate in outline, sometimes truncate at base, or cuneate and decurrent upon the petiole, 3-lobed or mostly 5-lobed usually beyond the middle, often large (sometimes 1½ or 2 feet broad or more); lobes acute or acuminate, entire or denticulate or sometimes coarsely sinuate-toothed; sinuses acute or rounded; petioles an inch or two long; stipules ocreate, deciduous, scarious with a foliaceous often much dilated entire or toothed limb, cleft next to the petiole: fertile heads 2 to 7 in a moniliform spike, an inch broad in fruit: nutlets tomentose when young, becoming glabrate, 3 lines long, beaked by a slender style one-half as long or more, the basal hairs two-thirds as long. — Audubon's Birds, t. 362; Nuttall, Sylva, i. 47, t. 15; Newberry, Pacif. R. Rep. vi. 33, t. 2, and fig. 10. *P. occidentalis,* Hook. & Arn. Bot. Beechey, 160 and 390. *P. Californica,* Benth. Bot. Sulph. 54.

A frequent and conspicuous tree from the Sacramento Valley to Southern California. Bark very white; wood brittle, but is said to receive a good polish and to be more durable than that of the eastern species. The largest tree whose measurement has been reported is growing in Santiago Cañon, Los Angeles County. This was measured by *Miss J. R. Bush* of San Jose, and found to be 29 feet and 7 inches in circumference.

Order LXXXVI. BUXACEÆ.

Monœcious trees or shrubs, or even herbs, with coriaceous simple evergreen leaves, without stipules, and regular 4 – 6-parted perianth free from the compound ovary; distinguished from the following order especially by the watery juice, loculicidal capsule, and inverted ovules, i. e. the anatropous ovules, suspended from the summit of the cells, have the rhaphe dorsal or averse from (instead of next to) the placenta or axis. Segments of the perianth imbricate in 2 rows: stamens 4 or more: ovary 2- or 3-celled, with as many short mostly excentric styles, and 1 or 2 ovules in each cell.

An order of 5 genera and 25 species, of tropical and warm-temperate regions, of which the Box (valuable for its fine-grained hard wood) is the type; represented in the Atlantic States by a single herbaceous species (*Pachysandra procumbens*), and on the Pacific by the following Californian genus, which is peculiar in having central styles, solitary ovules, and exalbuminous seeds with thin-coriaceous testa.

1. SIMMONDSIA, Nutt.

Perianth 5- (rarely 4- or 6-) parted. Stamens 10 or 12, with very short filaments on a raised receptacle. Ovary ovate, acuminate, 3-celled, with 3 linear reflexed central styles; ovules solitary. Fruit by abortion usually 1-celled and 1-seeded. Seed exalbuminous, with thin brown testa. Cotyledons thick and fleshy, coherent; radicle minute. — A low diffusely branched shrub, with opposite entire leaves; staminate flowers clustered upon short axillary peduncles or in short terminal compound racemes, the pisillate axillary and solitary.

1. **S. Californica,** Nutt. Younger branches, leaves and calyx covered with a short more or less dense simple pubescence: leaves oblong-lanceolate, acutish at each end, sessile or very shortly petioled, 1 to 1½ inches long and usually exceeding the internodes: peduncles with 2 to 4 linear or lanceolate bractlets, in fruit deflexed and a half inch long or less: sepals in staminate flowers obovate, 1½ lines long, in the fertile flowers oblong-lanceolate, 6 to 9 lines long: ovary glabrous: styles 2 or 3 lines long: capsule coriaceous, ovate, obtusely 3-angled and somewhat beaked, 9 lines long, filled by the large puberulent seed. — Hook. Lond. Journ. Bot. iii. 400, t. 16; Torrey, Bot. Mex. Bound. 202, t. 49; Müll. Arg. in DC. Prodr. xvi². 23. *Buxus Chinensis,* Link, Enum. ii. 386. *Celastrus obtusata,* Presl, Bot. Bemerk. 34. *Brocchia dichotoma,* Mauri, Cat. Ort. Napol. 1845, 80.

On dry hillsides in Southern California, from San Diego to Eastern Arizona. The species from the Cerros Islands (*S. pubulosa,* Kellogg), described in Proc. Calif. Acad. ii. 21, is apparently the same.

Order LXXXVII. EUPHORBIACEÆ.

Herbs, shrubs, or trees, with milky acrid juice, monœcious or diœcious commonly apetalous and often naked flowers, a free and usually 3-celled ovary, having one or a pair of collateral anatropous ovules (solitary in our species) pendulous from the summit of each cell, and maturing into a mostly 3-celled and 3-lobed elastically dehiscent capsule, the lobes septicidally separating and then loculicidally splitting into two valves, leaving a central axis; the crustaceous seeds with a large and straight embryo (having usually broad cotyledons) in the axis of rather scanty albumen. Stamens 1 to many. Styles or stigmas as many or twice as many as the cells of the ovary. Leaves mostly alternate and simple, often stipulate.

A huge order, of about 175 genera and over 3,000 species, of tropical and temperate regions, a half belonging to tropical America. Some of them are polypetalous or gamopetalous; others — such as *Euphorbia,* the largest genus, and the main one in cooler climates — have singularly reduced flowers, the staminate consisting of a single stamen, but so collected and masked in an involucre as to imitate a perfect blossom. Many of the species yield medicinal or otherwise useful products, some being actively poisonous and others affording wholesome food (as Manioc and Tapioca). The most important in cultivation is the Palma Christi or Castor Oil plant (*Ricinus communis,* Linn.). The order is sparingly represented in California, much more abundantly in Mexico and the adjoining parts of Arizona and New Mexico. Some additional species will probably be found in the desert portion of San Bernardino and San Diego counties.

* Both staminate and pistillate flowers usually with a perianth, without an involucre.

\+ Anthers incurved in the bud.

1. **Eremocarpus.** Capsule 1-celled, 1-seeded. Flowers in axillary clusters; the pistillate without perianth. A hoary densely stellate-pubescent and hirsute annual.
2. **Croton.** Capsule 3-celled, 3-seeded. Flowers in terminal spike-like racemes; all calyculate. (Erect gray-scurfy perennials.)

+ + Anthers erect in the bud.

++ Lobes of the staminate calyx valvate (the pistillate imbricate) : styles divided or none.

3. **Argythamnia.** Petals and sepals 5. Flowers in axillary spicate clusters. Styles bifid, linear.

4. **Bernardia.** Petals none. Sepals 3 (or 4). Staminate flowers very small, in axillary spicate clusters ; pistillate terminal. Stigmas sessile, very short, 2-lobed. Densely stellately pubescent shrubs.

5. **Acalypha.** Petals none. Calyx 4- (3–5-) parted. Staminate flowers in axillary ament-like spikes ; pistillate clustered ; all bracteate. Stigmas finely dissected. (A shrub, with dense simple pubescence.)

++ ++ Lobes of staminate calyx imbricate : styles simple : glabrous herbs.

6. **Stillingia.** Flowers in terminal spikes, pistillate below. Calyx 2 – 3-cleft. Stamens 2 or 3.

* * Flowers all without perianth, included in a cup-shaped calyx-like involucre.

7. **Euphorbia.** Pistillate flower solitary, soon exserted : the staminate numerous, each of a single stamen. Capsule 3-celled, 3-seeded.

1. EREMOCARPUS, Benth.

Flowers monœcious, in axillary cymose fascicles, without involucre and apetalous, and the pistillate without calyx. Staminate calyx 5 – 6-parted, slightly imbricate. Stamens 6 or 7, central on the hairy receptacle (disk obsolete) : filaments exserted : anthers inflexed in the bud. Ovary with 4 or 5 small glands at the base, 1-celled, 1-ovuled : style simple, filiform, stigmatic at the apex. Capsule obovate-oblong, 2-valved. Seed smooth and shining : albumen fleshy. Cotyledons broad, cordate, as long as the radicle. — A low heavy-scented annual, with alternate entire 3-nerved petiolate leaves, without stipules.

1. **E. setigerus,** Benth. Hoary throughout with a very dense stellate pubescence and hispid with stiff spreading hairs : stems stout, dichotomously branched from the base, mostly procumbent or ascending, a foot long or less : leaves thick, ovate, obtuse, cuneate or rounded at base, ½ to 2 inches long, on long petioles, the upper crowded and apparently opposite or ternate : staminate flowers pedicelled ; calyx with oblong obtuse segments a line long : pistillate flowers in the lower axils, 1 to 3 together : ovary and style densely pubescent : capsule and seed 2 lines long. — Bot. Sulph. 53, t. 26 ; Müll. Arg. in DC. Prodr. xv². 708. *Croton setigerus,* Hook. Fl. Bor.-Am. ii. 141.

Very abundant in dry valleys, especially near the coast, from S. California (San Pedro, *Coulter*) to the Columbia.

2. CROTON, Linn.

Flowers monœcious or rarely diœcious, mostly in terminal spikes or racemes, without involucre. Staminate calyx 4 – 6- (usually 5-) parted, slightly imbricate in the bud. Petals often present, but small or rudimentary, as many as the calyx-lobes and alternating with the glands of a central disk. Stamens 5 to many, on a hairy receptacle : anthers inflexed in the bud. Pistillate calyx usually 5-parted, but the petals mostly obsolete. Ovary 3- (2 – 4-) celled, with as many dichotomously branched styles : cells 1-ovuled. Seeds smooth and shining, carunculate. Cotyledons ovate, flattened, as long as the radicle. — Shrubs or perennial herbs, rarely annuals, scurfy or stellately hairy or sometimes glandular ; leaves alternate, petiolate, mostly entire, distinctly or obsoletely 2-stipulate. — Müll. Arg. l. c. 512.

About 450 species are enumerated, the genus being represented in most tropical and warm-temperate regions, especially in S. America and Mexico. Twenty species are found within the

limits of the United States, those of the Californian flora belonging to the section *Drepadenium* of Müller, densely gray-scurfy woody-based perennials, with a regularly 5-parted calyx, petals obsolete or nearly so, and capsule 3-celled.

1. **C. Californicus,** Müll. Arg. Perennial, woody at base, a foot high, with erect or ascending branches, hoary throughout with a dense appressed scurf or the upper side of the leaves finely stellate-pubescent: leaves oblong or sometimes broadly elliptical, obtuse at each end or rarely acutish, an inch or two long, on slender petioles 4 to 15 lines long: staminate flowers in short nearly sessile racemes; calyx-lobes about a line long: disk obscurely 5-lobed: filaments hairy: pistillate flowers often solitary, on short pedicels: styles twice dichotomous: capsule scurfy, 3 lines in diameter: seed 2½ lines long, with a small appressed caruncle. — DC. Prodr. xv². 691. *Hendecandra procumbens,* Esch.; Hook. & Arn. Bot. Beechey, 389, t. 91.

Var. **major.** Stouter and with large leaves, denser staminate racemes of larger flowers, and the pistillate flowers more numerous.

In sandy fields about San Francisco and southward to Los Angeles; the variety at Santa Barbara (*Nuttall*) and San Buenaventura, *Peckham.* The staminate racemes develop gradually, the flowers soon deciduous after opening and leaving an at length elongated naked rhachis.

2. **C. tenuis,** Watson. Like the ordinary form of the last, but more slender, decumbent, 1 or 2 feet high: leaves narrowly oblong, a half to an inch long, on short petioles 1 to 4 lines long: staminate flowers small and in small racemes: capsule smaller: seed 1½ lines long; the caruncle prominent, with a broad appressed lobed base. — Proc. Amer. Acad. xiv. 297.

At Potrero, San Diego County (*Cleveland*), and near Fort Mohave, *Cooper.* Near *C. Neo-Mexicanus,* Müll., of S. Utah and New Mexico, but differing in habit and fruit, as it does also from the Mexican *C. gracilis,* HBK., which moreover has larger flowers in large dense racemes.

3. ARGYTHAMNIA, P. Browne.

Flowers usually monœcious, in terminal or axillary simple racemes or clusters, pistillate below, without involucre. Calyx regularly 5- (rarely 3-) parted, valvate in the staminate flowers, imbricate in the pistillate. Petals alternate with the calyx-lobes and with the lobes of the glandular disk. Stamens 5 to 15 in 1 to 3 whorls; filaments united into a central column; anthers erect in the bud. Ovary 3-celled, 3-ovuled: styles once to thrice dichotomous. Seeds subglobose, roughened or reticulated, not caruncle: cotyledons orbicular, flattened, as long as the radicle. — Erect herbs or undershrubs, with purplish juice; leaves alternate, usually stipulate, toothed or entire.

A genus of 35 species, chiefly of tropical America, represented in the region bordering upon Mexico by 6 or 8 species belonging to the section *Aphora,* Müll. Arg., the stamens being in two whorls, the glands of the disk more or less free from the stamineal column, and the styles 2-parted.

1. **A. serrata,** Müll. Arg. Annual, branching from the base, a foot high or less, villous with rigid appressed centrally attached hairs: leaves oblong-obovate to oblanceolate, obtuse or acute, attenuate to a short petiole or nearly sessile, acutely serrate: racemes axillary, very short, 4–5-flowered, 1 or 2 of the flowers pistillate: sepals linear-lanceolate, a line or two long, shorter than the purplish rhombic-lanceolate petals (2 to 4 lines long), which are adnate at base to the short oblong obtuse glands and to the stamineal column: stamens 10, often with a terminal whorl of more or less developed sterile filaments: ovary very hispid: branches of the style linear: seeds a line in diameter, reticulated. — DC. Prodr. xv². 739. *Aphora serrata,* Torrey, Bot. Mex. Bound. 197.

In the Colorado Valley; near Fort Yuma (*Schott*), at the mouth of Williams River (*Palmer*), and on the Gila, *Parry.* Apparently the same also at Cape St. Lucas, *Xantus.*

2. **A. sericophylla,** Gray in herb. Perennial, shrubby at base, with slender virgate branches, appressed silky-villous: leaves narrowly lanceolate, acuminate, about 9 lines long: racemes axillary, very short and few-flowered: sepals 1 to 1½ lines long, linear, acuminate, equalling the narrow acuminate hairy petals: glands short, broad at base, narrowly acuminate above: stamens 6 to 10: capsule hairy: seeds a line in diameter, reticulate, the broad ridges rugose.

On the Verde River, Arizona (*Dr. Smart*); Big Cañon of the Tantillas Mountains, Lower California, *Palmer.*

4. BERNARDIA, P. Browne.

Flowers diœcious or monœcious, in small spicate or racemose clusters, mostly axillary, apetalous and without involucre. Staminate calyx valvate, 3–5-parted. Stamens 3 to 20, distinct, on a central sometimes glanduliferous receptacle; anthers erect in the bud. Pistillate calyx usually 6- (sometimes 3- or 9-) parted, imbricate. Ovary 3-celled, 3-ovuled: stigmas nearly sessile, stout, 2-lobed or -parted, the lobes lacerate or papillose. Seeds not carunculate. — Mostly shrubs or undershrubs, pubescent with stellate or simple hairs; leaves alternate, 2-stipulate, mostly serrate.

A tropical American genus of 20 species or more; only the following found within the United States.

1. **B. myricæfolia,** Watson. An irregularly branched shrub, 3 to 10 feet high, grayish green throughout with a dense fine stellate pubescence: leaves thick and reticulate-veined, oblong to ovate-oblong, usually obtuse, cuneate to cordate at base, from 3 to 6 lines to 2 inches long, often small, repandly dentate, on very short petioles: flowers diœcious; the staminate very small, in axillary racemose clusters; pistillate terminal, sessile: calyx 3- (rarely 4-) parted: stamens 3 to 20, alternate with minute glands: ovary tomentose: stigmas very short, papillose: seed 3 lines long, nearly smooth, dull, slightly carinate. — *Tyria myricæfolia,* Scheele in Linnæa, xxv. 581; Torrey, Bot. Mex. Bound. 201. *Ricinella myricæfolia,* Müll. Arg. in DC. Prodr. xv². 729.

On the headwaters of the Mohave (*Parry* & *Lemmon*); San Felipe (*Parry*); frequent in New Mexico and W. Texas, and in Northern Mexico. In habit resembling closely the other species referred by Müller to *Bernardia* § *Tyria,* from which there seems to be no good reason for separating it.

5. ACALYPHA, Linn.

Flowers monœcious, in the axils of wholly glandless bracts, spicate; the staminate very small, in ament-like spikes, with the few or solitary pistillate ones at the base or sometimes separate: involucre, petals and disk none. Staminate calyx 4-parted, valvate; the pistillate 3–5-parted and slightly imbricate. Stamens usually 8, distinct, on a central raised receptacle; filaments short; anthers long, erect in the bud, versatile, the cells separate and somewhat vermicular. Ovary 3-celled, 3-ovuled: styles 3, usually finely dissected or fringed, and red. Capsule often surrounded by the enlarged bract. Seed smooth or roughened or pitted. Radicle about equalling the ovate cotyledons. — Shrubs or undershrubs, or often perennial or annual herbs; leaves alternate, toothed, 2-stipulate.

A genus of all tropical regions, of over 200 species, very largely American but sparingly represented in the United States; half a dozen or more species, annual or perennial herbs, are found in the Atlantic and Southern States and near the Mexican border.

1. **A. Californica,** Benth. A shrub, with spreading rigid branches and brownish bark, puberulent on the young twigs: leaves ovate, somewhat cordate, acute, finely toothed, 3–5-nerved at base, finely and densely pubescent when young, at

length nearly glabrous, a half to an inch long, on very short petioles; stipules subulate, caducous: spikes terminal or axillary, short; the staminate 3 or 4 lines long, nearly sessile, dense, with often a fertile flower at the base; the pistillate 3–8-flowered, crowded, at length more open and half an inch long or less: fertile bracts reniform, finely toothed and strongly nerved, 2 lines broad, somewhat enlarged in fruit: sepals 3, lanceolate, acute: ovary densely tomentose: styles with lateral simple or forked branchlets: seed round-ovate, smooth and somewhat shining, nearly a line long. — Bot. Sulph. 51; Müll. Arg. in DC. Prodr. xv². 822.

Bay of Magdalena, Lower California (*Hinds*); San Diego County, near the Boundary Monument, "on stream-banks," *Palmer*. The latter specimens are in an early flowering state, but retaining a matured fruiting spike; the young leaves are all less than a half inch long.

6. STILLINGIA, Garden.

Flowers monœcious, in the axils of conspicuously 2-glandular bracts, in terminal or rarely axillary spikes which are pistillate at base: involucre, petals and disk none. Calyx imbricate in the bud; the staminate 2–3-cleft or 3-parted, the pistillate 3-parted or wanting Stamens 2 or 3, distinct or nearly so, central; filaments exserted; anthers erect in the bud, with adnate rounded cells. Ovary 3-celled, 3-ovuled: styles 3, filiform, entire. Lobes of the capsule deciduous from a stout horizontal 3-horned base (*gynophore*), often without a central column. Seeds smooth or roughened, usually carunculate. Radicle equalling the broad cordate cotyledons. — Smooth herbaceous or woody perennials, or some annual; leaves alternate, usually serrate, often 2-glandular at base; pistillate flowers solitary, the staminate 1 to 3 in each bract. — Müll. Arg. in DC. Prodr. xv². 1155. *Gymnostillingia*, Müll. l. c. 1163.

The genus as defined by Müller includes about a dozen widely scattered species, all perennials, of which two are found on the Atlantic coast, one of them ranging west into New Mexico and Northern Mexico. His genus *Gymnostillingia*, to which the following species might be referred, was founded upon two shrubby plants of Mexico and Guatemala, but the characters by which he distinguishes it (the want of a calyx in the pistillate flowers, the solitary staminate flowers, and the ecarunculate seed) seem hardly sufficient for more than a sectional or subgeneric division. The closely allied *Sebastiania*, Spreng., is distinguished chiefly by the absence of the gynophore.

* *Perennials: spikes terminal: leaves narrow, entire or nearly so.*

1. **S. linearifolia,** Watson. Herbaceous, branching from the somewhat woody base, a foot high or more: stems and branches slender, terete, ascending: leaves linear, entire, or rarely very obscurely glandular-toothed, acute, a half to an inch long: spikes very slender, open, 1 to 1½ inches long, with 2 to 7 scattered pistillate flowers below: bracts very small, ovate, acute, minutely glandular on each side, 1-flowered: staminate flowers very small; calyx turbinate: stamens 2: pistillate calyx none: capsule 1½ lines in diameter; the horns of the gynophore rather thin, and central column often persistent: seed round-ovate, acute, a line long, smooth, somewhat viscid, not carunculate. — Proc. Amer. Acad. xiv. 297.

San Diego, near the Boundary Monument (*Palmer*, n. 449, 1875); San Bernardino County, *Parry & Lemmon*, 1876, n. 376.

2. **S. paucidentata,** Watson. Herbaceous, the stout angled stems branching above: leaves linear, acuminate, an inch or two long with 2 or 3 setaceous teeth on each side usually near the base: spikes slender, but stouter and denser than in the last, with similar bracts and flowers; the pistillate flowers more crowded: capsule 2 lines in diameter, with very prominent gynophore: seeds 1½ lines long, oblong-ovate, acute and slightly carunculate, smooth. — Proc. Amer. Acad. xiv. 298.

Colorado Valley, near the mouth of Williams River, *Palmer*, 1876, n. 517.

* * *Annuals: spikes axillary: leaves lanceolate, toothed, 3-nerved.*

3. **S. annua,** Müll. Arg. Low (2 to 6 inches high), somewhat viscid, dichotomously branched, the stems angled and leafy: leaves ovate to lanceolate, acuminate, narrowed to a broad winged petiole, stoutly 3-nerved from the base of the petiole, ciliate- or spinulose-dentate, an inch long: spikes shorter than the leaves, with 1 to 3 naked pistillate flowers at base: staminate bracts minute, 1-flowered; the pistillate with small glands on long stout pedicels: capsule 2 lines in diameter, with prominent gynophore; central column wanting: seed oblong-ovate, 1½ lines long, smooth, with no caruncle or a very small one. — DC. Prodr. xv². 1160. *S. spinulosa,* Torrey, Emory's Rep. 152. *Sapium* (?) *annuum,* Torrey, Bot. Mex. Bound. 201.

In the desert region of S. E. California and eastward; on the Mohave (*Emory, Parry, Cooper*); Fort Yuma (*Schott*); S. Utah, *Bishop.* A very peculiar species.

S. Torreyana (*Sapium annuum,* var. *dentatum,* Torrey, Bot. Mex. Bound. 201; referred doubtfully to *Sebastiania Treculiana* by Mueller, l. c.) is another somewhat similar annual species, with sessile leaves, sharply and sometimes doubly toothed, rounded above, cuneate at base, faintly nerved, with short fimbriate stipules: spikes terminal, short and slender: bracts very small, ovate, acute, 1-flowered, with shortly stipitate convex glands: pistillate calyx of 3 triangular sepals: capsule 2 lines in diameter, with stout gynophore: seeds 1½ lines long, with conspicuous caruncle. Valley of the Rio Grande; distinct from *Sebastiania Treculiana,* which is of the same region and of similar habit, but with oblanceolate leaves and smaller subglobose seeds.

7. EUPHORBIA, Linn.

Flowers monœcious, included in cup-shaped 4–5-lobed involucres, the lobes usually alternating with as many fleshy glands which are rounded or often petaloid-margined or crescent-shaped. Staminate flowers numerous, of a single naked stamen, jointed upon a short pedicel which has usually a minute bract at base: anther-cells globose, distinct. Pistillate flower solitary in the centre of the involucre, pedicellate and soon exserted; calyx none or minute. Ovary 3-celled and 3-ovuled: styles 3, usually 2-cleft. Seeds often roughened, rugose or pitted, with or without caruncle. Cotyledons linear to ovate. — Mostly herbaceous (as to our species) perennials or annuals; leaves opposite or alternate or the upper ones verticillate, entire or toothed, often stipulate; involucres terminal or in the forks, solitary or umbellate-clustered, sometimes pseudo-axillary. — Engelm. in Bot. Mex. Bound. 185; Boissier in DC. Prodr. xv². 7.

A vast genus (of about 700 species) of all temperate and warmer regions, of very various habit and characteristics. Nearly 100 species are found within the limits of the United States, chiefly in the southern portion, low annuals or often taller herbaceous perennials, very rarely somewhat woody, with a single exception not shrubby or arborescent as frequently in the tropics.

I. *Glands of the involucre mostly with a colored membranaceous margin, entire or toothed (without margin and concave in* n. 1).

§ 1. *Leaves all opposite, oblique and unequal at base; stipules persistent, scale-like and entire or lacerate: involucres small. Our species mostly prostrate, slender and repeatedly branched from the base, with small leaves on very short petioles, the involucres solitary, rarely cymose, with* 4 *glands* (2 *to* 4 *in* n. 1); *seeds ash-colored.* — Anisophyllum, Roeper.

* *Seeds smooth (occasionally wrinkled in* n. 3): *leaves entire.*

1. **E. ocellata,** Dur. & Hilg. Annual, prostrate or ascending, glabrous and glaucous, the stems often 6 inches long: leaves thick, deltoid to ovate-oblong, acute, often cordate at base, 2 to 5 lines long; stipules setaceous, entire or sparingly cleft:

involucres campanulate, less than a line long, the lobes finely fringed: glands 2 to 4, shortly stipitate, circular and discoid, more or less concave, immarginate or rarely with a narrow margin, yellowish or purplish: staminate flowers very numerous: capsules nearly a line broad, the lobes rounded on the back: seeds round-ovate, obtusely angled, smooth or often obscurely rugose. — Pacif. R. Rep. v. 15, t. 18; Boiss. l. c. 28.

In dry valleys in the Coast Ranges from the Sacramento to Fort Tejon, near Fort Mohave (*Cooper*), and W. Nevada.

2. **E. albomarginata,** Torr. & Gray. Glabrous: stems numerous from a woody perennial base, prostrate or decumbent, 2 to 12 inches long: leaves nearly orbicular, 2 to 4 lines in diameter, often retuse above and somewhat cordate at base, with a thin whitish edge; stipules united into a conspicuous membranaceous white triangular scale, entire or slightly lacerate: involucres mostly solitary, campanulate or turbinate, less than a line long; the 4 orange or brownish glands with a very conspicuous dilated petaloid appendage, which is white or rose-colored and mostly entire: capsule nearly a line long, the lobes angled on the back: seeds oblong, 4-angled. — Pacif. R. Rep. ii. 174; Boiss. l. c. 30. *E. Hartwegiana,* Boiss. l. c. 31.

S. California, from Fort Tejon to San Diego, and eastward to Texas; also Mexican.

3. **E. polycarpa,** Benth. Glabrous or somewhat finely pubescent: stems numerous from a perennial at length woody base, prostrate or ascending, 2 to 12 inches long: leaves round-ovate to oblong, obtuse or acutish, usually slightly cordate at base, 1 to 3 lines long; stipules short-triangular to lanceolate, ciliate, minute: involucres mostly solitary in the axils, turbinate-campanulate, half a line long or less; glands dark purple (sometimes yellow), the white or rose-colored petaloid somewhat crenate margin varying from very narrow (or sometimes none) to very broad and conspicuous: capsule small, with angled lobes: seeds oblong, 4-angled, about half a line long, smooth or sometimes obscurely rugose. — Bot. Sulph. 50; Boiss. l. c. 50.

Var. **vestita.** Hoary and more or less tomentose throughout with short close pubescence. — *E. melanadenia,* Torrey, Pacif. R. Rep. iv. 135.

From Santa Barbara to Cape St. Lucas and eastward to the Rio Grande. *E. cinerascens,* Engelm. (Bot. Mex. Bound. 186), is a form with the appendage of the glands very narrow or wanting.

* * *Seeds transversely undulate-wrinkled or costate.*

+ *Annual or perennial: leaves entire.*

4. **E. setiloba,** Engelm. Annual, prostrate, pubescent throughout with soft spreading somewhat glandular hairs, reddish: leaves round-obovate to oblong, 1 to 3 lines long, mostly small, rounded above, cordate or slightly cuneate at base, on slender petioles a half to a line long; stipules nearly obsolete: involucres solitary in the axils and in small leafy clusters terminating the branchlets, narrowly turbinate, nearly glabrous within, the lobes ciliolate; glands erect, purple, with a narrow fimbriate white or rose-colored margin: capsules pubescent, angled, scarcely over a half line long: seeds oblong, acutely 4-angled, somewhat rugose transversely. —Pacif. R. Rep. v. 364; Boiss. l. c. 44.

San Bernardino (*Parry*), and in the Colorado Valley from Fort Yuma northward, *Thomas, Newberry, Palmer.*

5. **E. pediculifera,** Engelm. Usually perennial, hoary throughout with a close puberulence: stems numerous, prostrate or ascending: leaves ovate to oblong, rounded or obtuse above, broad and slightly cordate to cuneate at base, 2 to 6 lines long: involucres large, hemispherical, mostly solitary; glands large, dark brown, with a conspicuous (sometimes nearly wanting) white or rose-colored crenate margin: capsules pubescent, a line long, the lobes rounded on the back: seeds broad-oblong,

rather obtusely angled, surrounded by 4 deep transverse grooves. — Bot. Mex. Bound. 186; Boiss. l. c. 48.

Big Cañon of the Tantillas Mountains (*Palmer*), and through Arizona (*Schott, Palmer, Rothrock*) to New Mexico, *Wright.*

++ *Annuals: leaves serrulate.*

6. **E. serpyllifolia,** Persoon. Glabrous: stems prostrate or ascending, becoming a half to one foot long: leaves obovate to narrowly oblong, often narrowed toward the very oblique base, denticulate (sometimes obscurely) at the rounded or retuse summit, 2 to 6 lines long; stipules distinct, setaceous or lacerate: involucres solitary or in loose leafy clusters, campanulate, ½ line long or less; glands small, the narrow whitish margin crenate or entire: capsule angled, a line long: seeds sharply 4-angled, the sides somewhat rugose and slightly pitted or sometimes nearly smooth. — Boiss. l. c. 43. *E. inæqualatera,* Engelm. in Bot. Mex. Bound. 187.

A common species, especially in the Great Basin, ranging from the Columbia River to Monterey, eastward to the Saskatchewan and southward to Iowa, Texas and Mexico.

E. GLYPTOSPERMA, Engelm. (Bot. Mex. Bound. 187), is a similar species, distinguished by its decidedly semicordate (the lower side produced) sharply serrulate leaves, and its seeds with 4 or 5 sharp transverse ridges and notched angles. It occurs on the Columbia River and eastward to Wisconsin, but has not been found in California or Nevada.

7. **E. hirtula,** Engelm. ined. Villous with soft spreading hairs, prostrate or ascending, the stems 3 or 4 inches long: leaves very oblique, round-oval or obovate to broadly oblong, serrulate toward the rounded apex, 2 or 3 lines long; stipules distinct, fimbriate-setaceous: involucres solitary or in leafy clusters, deeply campanulate, about equalling the pedicels; glands minute, with a narrow crenate margin: capsules somewhat villous, angled, a line long: seeds broadly ovate, 4-angled, irregularly and rather faintly wrinkled or pitted.

Near San Diego (*Cleveland*); at Talley's in the Cuyamaca Mountains, *Palmer.* Nearly "allied to *E. stictospora* and *E. vellligera*" (Engelmann); distinguished chiefly by the narrower and more incised stipules, and by the thicker smoother and lighter colored seeds.

§ 2. *Shrubs, with scattered leaves, entire and not oblique at base, on slender petioles: glands* 5: *seeds ovate.* — TRICHEROSTIGMA, Boiss.

8. **E. misera,** Benth. A much branched straggling shrub, 2 or 3 feet high: young branches pubescent: leaves minutely puberulent or glabrate, solitary or few upon the short branchlets, round-obovate, obtuse or retuse, mostly cuneate at base, 2 to 6 lines long, exceeding the petioles; stipules fimbriate: involucres hemispherical, solitary and terminal, a line long; lobes short, inflexed; glands purple, with a white crenulate margin: capsules 2 lines long, with rounded lobes, somewhat warty: seeds round-ovate, reticulate-wrinkled or obscurely pitted, 1½ lines long. — Bot. Sulph. 51; Boiss. l. c. 69.

Southern California, from Santa Barbara to San Diego, near the sea, *Hinds, Nuttall, Cleveland.*

II. *Glands of the involucre without a colored margin, entire or denticulate or crescent-shaped. — The following sections have scattered (rarely opposite) leaves, those of the terminal cymose-corymbose inflorescence opposite or verticillate: our species erect or ascending, herbaceous.*

§ 3. *Glands cup-shaped (in ours cleft on the inner side): involucres in terminal clusters: stipules gland-like, minute.* — POINSETTIA, Boiss.

9. **E. eriantha,** Benth. Stems herbaceous and slender, ascending from a woody apparently perennial base, branching, nearly a foot high, glabrous: leaves scattered and distant, narrowly linear, acute or obtuse and mucronate, often 3-toothed at the apex, attenuate to a short petiole, sparingly pubescent, entire, an inch or two long; the floral ones similar, opposite, much exceeding the flowers: involucres 1 to 3 at

the end of each branch, hoary-pubescent, campanulate, nearly a line long, on short pedicels; the incurved lobes fimbriate-pectinate with densely pubescent teeth and the 3 to 5 thin glands with a broad similarly fimbriate margin cleft on the inner side: styles undivided: capsule finely pubescent, obtusely 3-lobed, 2 lines long: seeds dull white, quadrate-oblong and compressed, obtusely angled, coarsely and rather faintly wrinkled; caruncle conspicuous. — Bot. Sulph. 51; Boiss. l. c. 73.

Magdalena Bay, Lower California (*Hinds*); Sonora (*Wright*); Big Cañon of Tantillas Mountains, and Camp Grant, Arizona, *Palmer*. The description is drawn from the latter specimens. The original is described as having the leaves sharply and remotely dentate or rarely entire, the upper ones whitish at base, the involucres 3 to 5 on each branch, nearly sessile, and the (immature) seeds densely covered with depressed tubercles.

§ 4. *Glands flattened or convex: stipules none: involucres in dichotomous or often umbellate cymes, 4–5-lobed.* — TITHYMALUS, Boiss.

* *Glands rounded and discoid, entire.*

10. **E. dictyosperma,** Fisch. & Mey. Annual, glabrous, usually erect, ½ to 1½ feet high: stem simple below or often branching from the base, dichotomously branched above: cauline leaves scattered, oblong- to obovate-spatulate, obtuse and obtusely serrulate, often retuse, ½ to 1½ inches long; on the branches opposite, broadly ovate to oblong, the floral ones round-ovate, subcordate, mucronate, 2 to 6 lines long: rays usually 3, 2 to 4 times forked: involucres and glands small: styles bifid or parted: capsule with rounded and warty lobes, 1 to 1½ lines long: seeds subglobose, delicately net-veined, dark-colored, with thin flattened caruncle. — Boiss. l. c. 135. *E. Arkansana,* Engelm. & Gray, Pl. Lindh. 53.

From Oregon to Santa Barbara County (*Brewer*) and Mono Pass (*Bolander*), but more frequent eastward on the plains from Nebraska to Texas and New Mexico.

* * *Glands crescent-shaped, 2-horned or denticulate: leaves entire.*

+ *Cauline leaves scattered, obovate to spatulate: seeds ash-gray, pitted or mottled: capsule smooth.*

11. **E. leptocera,** Engelm. Annual or sometimes biennial, glabrous, erect or decumbent at the branching base, a foot high: leaves obovate-spatulate, obtuse, often mucronate, ½ to 1¼ inches long, the upper ones sometimes erose-denticulate; those on the branches and the floral ones opposite or usually ternate, deltoid or broadly rhombic-ovate, sometimes connate, acute, 3 to 6 or 8 lines broad: branches 2 or 3 times dichotomous, the upper nodes much the shorter: involucres turbinate, the oblong lobes nearly entire; glands large, crescent-shaped, the slender horns sometimes cleft: styles elongated, bifid: capsule 2 lines broad: seeds usually ash-colored, oblong-ovate, conspicuously dark-pitted, nearly 1½ lines long, with a prominent caruncle. — Pacif. R. Rep. iv. 135; Boiss. l. c. 143. *E. crenulata,* Engelm. in Bot. Mex. Bound. 192.

Nearly throughout the State; from Ventura County (Ojai, *Peckham*) to Plumas County, and Oregon, *Hall.*

12. **E. Palmeri,** Engelm. ined. Perennial, stout, glabrous, the stem erect, a foot high or more, with a few short lateral branches and umbelliferous above, the 4 or 5 rays once or twice dichotomous: leaves ovate, obtuse, shortly petiolate, 6 to 9 lines long; of the inflorescence very broadly rhombic-ovate to subreniform, very obtuse, mostly apiculate: involucres a line long, with rounded entire ciliate lobes; glands shortly stipitate, crenate above and slightly horned: styles short, united at base, bifid to the middle: capsule ovate, 2 lines long: seeds ovate, rugose, 1⅓ lines long.

At Talley's Ranch in the Cuyamaca Mountains, *Palmer* (n. 450, 1875).

13. **E. schizoloba,** Engelm. Perennial, glabrous or slightly puberulent above, somewhat glaucous: the herbaceous stems erect or decumbent at base, 6 to 10 inches

high, once to thrice trichotomous; the upper nodes short: leaves oblong-ovate, acute, 4 to 6 lines long; floral ones ternate, very broadly ovate, cuspidate: involucres a line long, with truncate or emarginate or bifid lobes; glands stipitate, broadly dilated, crenate or irregularly indented: styles elongated (much longer than the ovary), united at base. — Proc. Am. Acad. v. 173; Boiss. l. c. 148. *E. incisa*, Engelm. in Ives' Rep. 27.

W. Arizona; Railroad Pass in the Cerbat Range (*Newberry*), and at Cottonwood Creek, 75 miles west of Prescott, *Palmer*. Some other perennial species of this group are found in Arizona and may reach S. E. California: — E. CAMPESTRIS, Cham. & Schlecht. (*E. esulæformis*, Schauer), glabrous, with lanceolate acute leaves; E. SUBPUBENS, Engelm., pubescent, with obtuse broadly spatulate leaves; etc.

\+ + *Leaves opposite, linear to oblong-lanceolate, large.*

14. **E. Lathyris**, Linn. Annual or biennial, glabrous, erect, stout, 1 to 3 feet high; branches of inflorescence umbellate and twice or thrice dichotomous: leaves sessile, obtuse and cuspidate, 3 or 4 inches long, the lower linear, the upper oblong-lanceolate, cordate at base; the floral oblong-ovate: glands crescent-shaped, with broad obtuse horns: capsule 4 lines in diameter, with rounded lobes, smooth becoming wrinkled: seeds reticulate-rugose, carunculate.

Naturalized about Monterey and San Buenaventura; a native of S. Europe and W. Asia, now very widely distributed.

ORDER LXXXVIII. CALLITRICHACEÆ.

Small slender herbs, mostly aquatic, with opposite entire leaves, no stipules, and monœcious axillary flowers without perianth, but often with 2 membranous bracts; stamen 1, with slender filament and heart-shaped 4-celled anther; ovary 4-celled, with 2 filiform papillose styles, mostly deciduous, and a pendulous anatropous ovule in each cell; fruit 4-lobed, flattened and emarginate, 4-seeded, indehiscent; embryo slender, in the axis of oily albumen, the cotyledons very short and radicle superior. Flowers mostly solitary, sometimes a male and female in the same axil. Cells of the fruit separating at maturity.

A single genus of 15 to 20 or more rather obscurely defined species (the number much reduced by some authors), found mostly in still waters or sometimes terrestrial, in almost every part of the globe. Five other species are credited to the Atlantic States. The affinities of the order are various and its position disputed. It is often included among the *Haloragaceæ*, but on the other hand has many characters of the *Euphorbiaceæ*, from which it differs most strikingly in the two styles and 4-celled indehiscent fruit.

1. CALLITRICHE, Linn. WATER-STARWORT.

Characters as of the order.

* *Amphibious: floating leaves obovate-spatulate, 3-nerved, the submersed linear; all uniform and narrow in terrestrial forms: carpels connate.*

\+ *Fruit pedicellate, wing-margined: bracts none.*

1. **C. marginata**, Torr. Often small and rooting in the mud, with linear or linear-oblanceolate leaves 2 or 3 lines long or less, or sometimes floating with very slender stems and rather broadly spatulate upper leaves: styles elongated, reflexed, soon deciduous: mature fruit on slender spreading pedicels (1 to 4 lines long), deeply emarginate above and below, broader than high, the margins of the thick carpels widely divergent and narrowly winged. — Pacif. R. Rep. iv. 135; Hegelmaier, Verhandl. Bot. Verein. Brandenb. ix. 12, fig. 19–23, and x. 102.

From Stanislaus and San Mateo Counties northward; Arroyo del Puerto (*Brewer*); near Searsville and Ukiah (*Bolander*); Mark West Creek, *Bigelow*. Chilian forms are also referred to it by Hegelmaier.

C. SEPULTA, Watson, resembles the terrestrial form of this species, prostrate and rooting, with small narrowly linear leaves. The fruit, however, is on stout pedicels (1 or 2 lines long), with acute slightly divergent margins, and is soon deflexed and buried in the soil. It is allied to *C. deflexa* and *C. Nuttallii*. Collected in Oregon (*E. Hall*), and to be looked for in California.

+– +– *Fruit sessile (or very nearly so), with acute or obtuse margins: bracts present.*

2. **C. verna**, Linn. Perennial, with elongated stems and floating rosulate obovate often emarginate leaves, which are more or less narrowly petioled, the submerged ones from spatulate to linear; sometimes terrestrial and rooting, with short linear leaves: bracts often exceeding the fruit, rarely wanting: styles erect or spreading, usually shorter than the fruit, deciduous: fruit orbicular or slightly obcordate or more usually elliptical, nearly a half of a line long, emarginate, and with acute or very narrowly winged slightly divergent margins.

From San Mateo and Sierra Counties northward, and eastward across the continent; found also in Europe, Asia and South America. The species is very variable, and *C. stenocarpa*, Hegelm. l. c., x. 114 (at Searsville and near Ukiah, from *Bolander*, growing with *C. marginata*), appears to be only a form with somewhat obcordate fruit, usually thicker below, and with elongated styles and bracts.

3. **C. Bolanderi**, Hegelm. l. c. 116. Very similar to *C. verna*, with stouter elongated stems and rhombic-obovate floating leaves: styles elongated: fruit orbicular or somewhat obcordate, with obtuse closely approximate margins.

Near Auburn, Placer County (*Bolander*); Oregon, *Hall*.

* * *Submersed perennial, with numerous uniform linear 1-nerved leaves: flowers without bracts: carpels separate nearly to the axis.*

5. **C. autumnalis**, Linn. Stems very slender: leaves 2 to 6 lines long, truncate or retuse at the apex: fruit sessile, round, deeply notched, nearly a line in diameter, the margins thin or at length winged: styles long, reflexed, caducous.

Sierra County (*Lemmon*) and north and eastward across the continent; also in N. Asia and Europe.

ORDER LXXXIX. PIPERACEÆ.

Perennial acrid herbs (in our species), with creeping rootstock and jointed or scape-like stems, entire petioled leaves, and mostly perfect bracteate flowers in dense terminal spikes or racemes, without perianth; ovary 1 – several-celled, with erect or ascending orthotropous ovules; stigmas 1 to 5; fruit capsular or follicular or baccate; seeds with thick coriaceous testa; embryo minute in a small sac at the apex of the albumen. Stamens 3 to 6 or more, free or more or less adnate to the ovary. Leaves dilated at base or sheathing, without stipules.

The true *Piperaceæ*, distinguished by a 1-celled ovary containing a single erect ovule and becoming a dry or fleshy berry, are confined chiefly to tropical or subtropical regions and are unknown in the United States, with the exception of a single *Peperomia* native to Florida. The Asiatic species are often shrubs or trees, and furnish the Black Pepper and Cubebs of commerce. The *Saurureæ* have the ovary 3 – 5-celled, or 1-celled with 3 to 5 parietal placentæ, and two or more ovules on each placenta. This suborder includes but three genera, belonging to China and Japan, excepting the following genus and a single species (*Saururus cernuus*) of the Atlantic States.

1. ANEMOPSIS, Hooker. YERBA MANSA.

Flowers in a close conical spike with a 5 – 8-leaved persistent colored involucre, each flower subtended by a free colored bract. Stamens 6 to 8, the short filaments

adnate to the ovary at base. Ovary sunk in the rhachis of the spike, 1-celled, of 3 or 4 carpels, with as many spreading stigmas and parietal 4–10-ovulate placentæ. Capsule dehiscent at the top. Seeds rounded, punctulate. — Stoloniferous saline herbs, with a thick strongly pungent astringent and aromatic rootstock; leaves mostly radical, rather thick, minutely punctate. — *Anemia*, Nutt.

Only the following species; nearly allied to *Houttuynia* (of 1 or 2 species) of E. Asia.

1. **A. Californica**, Hook. More or less floccose: stems ½ to 1½ feet high, with a broadly ovate clasping leaf above the middle and a fascicle of 1 to 3 small petioled leaves in the axil: radical leaves elliptic-oblong, rounded above, more or less narrowed toward the cordate base, 2 to 6 inches long, somewhat ciliate; petioles about equalling or shorter than the blade, dilated and sheathing at the very base: bracts of the involucre white, oblong, unequal, 6 to 15 lines long: spike ½ to 1½ inches long: floral bracts white, rounded or oblong, unguiculate, 2 or 3 lines long: ovules 6 to 10 on each placenta. — Ann. Nat. Hist. i. 136; Hook. & Arn. Bot. Beechey, 390, t. 92; Hook. Bot. Mag. t. 5292; C. DC. Prodr. xvi[1], 237; Watson, Bot. King Exp. 426.

In moist saline localities, from the Sacramento to Southern California, and eastward to S. Utah and the Rio Grande; Northern Mexico. Common near the southern coast, and much used for medicinal purposes by the Indians and Mexicans. A second species (*A. Bolanderi*, C. DC., Linnæa, xxxvii. 333) is described as smooth, with petioles elongated (8 inches long) and sheathing for a third of their length; veinlets 10 to 12 on each side of the midrib; ovules about 4 on each placenta. It is reported as collected by *Bolander* in California, but is known only from the description and is probably not distinct.

Order XC. CERATOPHYLLACEÆ.

Perennial aquatic submerged herbs, with cylindric jointed stems and branches, verticillate sessile filiformly 2–3-chotomous leaves without stipules, and monœcious axillary sessile flowers, without perianth, but surrounded by a persistent 8–12-cleft involucre; anthers numerous, sessile, fleshy, 2–3-cuspidate at top; ovary solitary, 1-celled, with a pendulous orthotropous ovule; akene beaked by the slender persistent style, and usually with lateral spines or margined; seed with membranous transparent testa and no albumen; radicle inferior, very short, the cotyledons thick and oval, and the highly developed plumule consisting of several nodes and leaves. — A single genus of few species (perhaps forms of one), widely distributed around the globe.

1. CERATOPHYLLUM, Linn. Hornwort.

Characters as of the order.

1. **C. demersum**, Linn. Stems very slender, a foot or two long, smooth or nearly so: leaves in numerous whorls of 6 to 8; the filiform or linear segments acute, more or less aculeate-dentate, ¼ to 1 inch long: akene 2 lines long or more, elliptical, somewhat compressed, shortly stipitate, with a short spine or tubercle on each side near the base, not margined: style as long as the akene. — Schkuhr, Handb. iii. 253, t. 297; Benth. Fl. Austral. ii. 491. *C. apiculatum*, Chamisso in Linnæa, iv. 503, t. 5, fig. e.

Near San Francisco (*Chamisso*); the fruit is described and figured as having a weak style, smooth, and with only a small tubercle on each side near the base. It has also been collected at Clear Lake and other localities in Northern California, in Western Nevada, and in Washington

Territory, but mostly without fruit. A single fruiting specimen from Sauvies Island, Willamette Slough, Oregon (*Howell*), has a stout straight style and a reflexed horn on each side at base 3 lines long, the sides slightly tubercled, resembling Chamisso's *C. tuberculatum*, l. c. fig. d, also figured in Wight, Icon. vi. 5, t. 1948, fig. 3. In the several forms, common in various countries, the fruit varies greatly, having the sides often more or less covered with small tubercles and sometimes crested, the margin wingless or surrounded by a toothed wing, or bearing 2 to several reflexed prickles, and the style variable in length and thickness.

Order XCI. BETULACEÆ.

Monœcious trees or shrubs, with deciduous simple and toothed alternate leaves, distinct caducous stipules, scaly buds, and flowers sessile at or on the base of scaly bracts of the terminal or lateral aments, usually 2 or 3 within each bract; the staminate with a 4-lobed or scale-like perianth and 2 or 4 stamens; the pistillate naked; bracts enlarging and becoming rigid in fruit; ovary of two 1-ovuled cells (one often empty), crowned with 2 sessile filiform stigmas, becoming a winged or angled nutlet. Seed anatropous, pendulous, with no albumen. Embryo straight and radicle superior; cotyledons flat, foliaceous in germination. Young aments resinous-coated. The two genera are widely distributed through the temperate and cold climates of the northern hemisphere.

1. **Betula.** Stamens 2, with bifurcate filaments and separate anther-cells. Bracts 3-lobed, becoming coriaceous and caducous. Nutlet broadly winged.
2. **Alnus.** Stamens 4; anther-cells contiguous. Bracts entire, becoming woody, persistent. Nutlet not winged.

1. BETULA, Tourn. Birch.

Bracts of staminate aments shield-shaped, including 2 bractlets and 3 flowers; calyx of a single entire scale-like sepal. Stamens 2, with bifid filaments, the branches bearing the distinct anther-cells. Bracts of pistillate aments 3-lobed, 2–3-flowered, imbricated, coriaceous in fruit and deciduous. Nutlets lenticular, surrounded by a broad membranous wing and tipped by the spreading stigmas. — Trees or shrubs with smooth laminated outer bark, the flowers appearing with or before the leaves; staminate aments long and drooping, solitary or in pairs, from leafless lateral or terminal buds; fertile aments oblong or cylindrical, solitary or racemose, from lateral 3–5-leaved buds.

About 30 species are described, a third of which are found in the northern and eastern portions of America. The wood is tough and usually fine-grained, valuable for cabinet-work.

1. **B. occidentalis,** Hook. Becoming 10 or 20 feet high, with close dark-colored bark (at length light brown); branches more or less resinous-dotted at the extremities: leaves thin, broadly ovate, acute, truncate or rounded or somewhat cuneate at base, 1 to 1½ inches long, with short glandular-tipped serratures and often obscurely lobed, somewhat resinous above, smooth or slightly appressed-villous beneath; petioles slender, 3 to 5 lines long: fruiting aments oblong-cylindric, 8 to 12 lines long, with pubescent ciliate divaricately 3-lobed bracts: wings of the nutlet as broad as the body or broader. — Fl. Bor.-Am. ii. 155; Nutt. Sylva, i. 22, t. 7; Watson, Bot. King Exp. 323, t. 35.

In the eastern cañons of the Sierra Nevada above Owen's Valley, at an altitude of from 4,500 to 10,000 feet, where it is reported as abundant and often the main reliance of the settlers for timber for fencing and other purposes; Surprise Valley, Modoc County (*Lemmon*), and common along streams in Siskiyou County, where it is known as "Black Birch." It is frequent from Washington Territory to the Saskatchewan, and in the Rocky Mountains to New Mexico.

2. **B. glandulosa,** Michx. A low bush, 4 to 6 feet high or less, the dark-colored branches usually more or less resinous-glandular: leaves small (a half to an inch long), obovate to oblong-obovate, mostly cuneate at base, rounded and crenate above, on slender petioles 1 to 3 lines long, smooth and often resinous-coated: fruiting aments 3 to 12 lines long; the deeply 3-lobed bracts slightly ciliate: seed orbicular-winged. — Flora, ii. 180; Regel, DC. Prodr. xvi². 172; Gray, Manual, 460.

Plumas County (*Mrs. R. M. Austin*); Oregon (*Hall*); northward to Sitka and east through British America to the Atlantic, in the Rocky Mountains, and in the colder portions of the Northern States.

2. ALNUS, Tourn. Alder.

Bracts of staminate aments shield-shaped and stipitate, including 5 bractlets and usually 3 flowers; perianth regular, 4-lobed. Stamens 4, opposite the lobes, with very short filaments and contiguous anther-cells. Bracts of pistillate aments fleshy and imbricate, including 4 bractlets and 2 flowers, cuneate and slightly 4-lobed, in fruit persistent and woody, thickened and truncate above, at length divergent. Nutlets compressed, mostly wingless or nearly so. — Shrubs or small trees, in moist places, with smooth bark, the flowers preceding or appearing with the leaves; aments terminating leafless branchlets or peduncles, the staminate long and drooping, the pistillate ovoid or oblong, erect.

A genus of about 15 species, half of them American. The timber is almost imperishable in water, the wood is valuable in cabinet work, the bark is used for tanning and dyeing, and the charcoal is usually employed in the manufacture of gunpowder. The Californian species belong to section *Gymnothyrsus*, Spach, the flowers preceding the leaves, and the racemed aments formed the previous year.

* *Fruit surrounded by a narrow somewhat membranous wing.*

1. **A. rubra,** Bongard. Branches rather stout, dark brown dotted with white: leaves thick, rusty-pubescent beneath, glabrate above, ovate to elliptic, 2 to 6 (sometimes 8) inches long, acute, rounded or more or less cuneate at base, coarsely and rather obtusely toothed, the teeth crenate and margin narrowly revolute: fruiting aments roundish ovate to oblong, a half inch or sometimes an inch long, the bracts much thickened above: nutlets 1¼ lines long, nearly orbicular or obovate. — Veg. Sitch. 162; Regel, DC. Prodr. xvi². 186. *A. Oregana,* Nutt. Sylva, i. 28, t. 9. *A. incana,* var. *rubra,* Regel, Monogr. 99, t. 17, fig. 3, 4.

From Sitka to San Francisco; frequent on the Oakland Hills. Described by Nuttall as becoming 30 or 40 feet high, and Bolander speaks of it as a large tree.

* * *Fruit more or less acutely margined, not winged.*

2. **A. rhombifolia,** Nutt. Branches more slender, dark brown, scarcely dotted: leaves slightly pubescent beneath, smoothish above, ovate (or obovate) to ovate-oblong, 2 or 3 inches long, rounded at the summit or acute, cuneate at base, irregularly glandular-denticulate: fruiting aments oblong, 6 to 8 lines long, the bracts rather thin above: nutlets a line long, very broadly obovate, with a thickened margin. — Sylva, i. 33. *A. glutinosa,* var. *serrulata,* Regel, Monogr. 106, in part. *A. serrulata,* var. *rugosa,* Regel, DC. Prodr. xvi². 188, in part.

From Oregon (*Hall*) to Southern California; at San Felipe (*Palmer*), known as "White Alder." "The common California alder, 20 to 30 feet high and 2 or 3 feet in diameter," according to *Bolander;* 30 to 50 feet high, *Peckham.* Bark light ash-gray.

3. **A. oblongifolia,** Torrey. Branches light brown, sparingly dotted: leaves thick, slightly pubescent or glabrous beneath, smooth above, oblong-lanceolate, 2 to 6 inches long, acute or acuminate, cuneate at base, serrate, the teeth with scattered glandular denticulations: staminate aments stout, 2 to 4 inches long: fruiting

aments oblong to ovate, 4 to 6 lines long: nutlets very broadly obovate, $1\frac{1}{3}$ lines long, thinly margined or narrowly winged. — Bot. Mex. Bound. 204. *A. serrulata*, var. *oblongifolia*, Regel, DC. Prodr. xvi². 188.

In the Cuyumaca mountains, San Diego County, and eastward to New Mexico, and in Northern Mexico; growing 20 to 30 feet high.

4. **A. incana,** Willd., var. **virescens,** Watson. Branches grayish brown: leaves more or less broadly ovate, 2 or 3 inches long, acute, rounded at base or slightly cordate, acutely doubly toothed, light green and glabrous on both sides or sparingly pubescent: staminate aments rather slender, $1\frac{1}{2}$ to 2 inches long: fruiting aments ovate-oblong, 4 to 6 lines long: nutlets round-obovate, thinly margined, $1\frac{1}{2}$ lines long. — *A. incana*, var. *glauca*, Regel, l. c. 189, in part; Watson, Bot. King Exp. 323. *A. serrulata*, var. *rugosa*, Regel, l. c. 188, in part.

From Oregon to the Saskatchewan and southward in the mountains to the southern Sierra Nevada and New Mexico; frequent on the eastern slope of the Sierra, and reported by Muir as forming dense thickets along the branches of the San Joaquin, King's and Kern Rivers at an altitude of 6,000 to 7,000 feet. It is seldom large, usually 8 to 15 feet high. In the Atlantic States it has the leaves much more densely pubescent and hoary, nearly resembling the typical form of the Old World, or sometimes smoother and glaucous beneath.

Order XCII. MYRICACEÆ.

Shrubs, monœcious or diœcious, with alternate usually waxy-dotted and fragrant leaves, mostly without stipules, and flowers solitary and sessile in the axils of scaly bracts of the axillary sessile ovoid or cylindrical aments; perianth none; stamens 2 to 16, sessile, or the filaments somewhat united; ovary with 2 to 4 small scales or bractlets at base, 1-celled, 1-ovuled, with 2 sessile filiform stigmas; nut small, drupe-like, often waxy; seed erect, orthotropous, with thin membranous testa and no albumen; radicle superior, elongated.

An order of chiefly a single genus of 30 or 40 species; one species European (*Myrica Gale*), the rest belonging to North America, S. Africa, and the mountains of Asia and Java. Wax is obtained in abundance from the fruit of several species.

1. MYRICA, Linn. Bayberry. Wax-Myrtle.

Characters as of the order.

* *Monœcious: aments androgynous, the staminate flowers below: bractlets minute at the base of the globular waxy fruit.*

1. **M. Californica,** Cham. An evergreen shrub or small tree: leaves thick and coriaceous, usually slightly tomentose below, oblanceolate, 2 to 4 inches long, acute, attenuate to a short petiole, serrate above the base: aments simple or somewhat compound, 3 to 5 lines long; the small very broadly ovate obtuse bracts more or less lacerately ciliate, especially near the base: staminate flowers few; stamens about 10 (6 to 15), the filaments united into an exserted panicle: bractlets usually 2, oblong, ciliate: fruit purple, papillose, thinly coated with grayish white wax, 2 lines in diameter. — Linnæa, vi. 535; Lindl. in Journ. Hort. Soc. Lond. vii. 282, with fig.; C. DC. Prodr. xvi². 153.

From the Sacramento to Washington Territory, in moist places or on hillsides. Of close erect habit and dark evergreen foliage, in the neighborhood of San Francisco sometimes attaining a height of 30 or 40 feet, with a diameter at base of 2 feet or more.

* * *Flowers diœcious: bractlets exceeding and adnate to the subcompressed naked fruit.*

2. **M. Hartwegi,** Watson. A diffuse shrub, 3 to 6 feet high: branches more slender and elongated: leaves deciduous, thinner, oblanceolate, 2 inches long, acute,

attenuate to a short petiole, serrate above the base, pubescent especially on the margin, as also the branchlets: staminate aments cylindrical, 5 to 8 lines long, many-flowered; bracts imbricated, glabrous, brown with a scarious border, very broadly ovate, acute, 1½ lines long: stamens 3 or 4, shorter than the bracts, the filaments united at base: pistillate aments 2 lines becoming 4 or 5 lines long, the bracts similar but much smaller: nutlets a line long, laterally compressed and winged by the thickened acutely tipped bractlets, naked or with scattered resinous globules. — Proc. Am. Acad. x. 350. *M. Gale*, Benth. in Pl. Hartw. 336.

Collected by *Hartweg* on the Sacramento, by *Fremont*, near Big Tree Grove (*Bolander*) and near Clark's Station on the South Fork of the Merced by *Muir*. Much resembling *M. Gale*, Linn., of Europe, subarctic America and the Atlantic States.

Order XCIII. SALICACEÆ.

Trees or shrubs, with alternate simple leaves, scaly and deciduous or leafy and persistent stipules, and diœcious flowers in terminal aments, each flower subtended by a membranous bract, without perianth; stamens 2 to several, central or scattered upon a glandular disk; ovary 1-celled, with 2 often sessile stigmas, and 2 parietal many-ovuled placentæ; capsule 2-valved, with numerous erect minute comose seeds; albumen none; radicle inferior.

Only the two following genera, belonging to the northern hemisphere, usually preferring wet or damp places. The wood is light and soft, and the bark contains bitter principles (*salicin* and *populin*) used in the cure of intermittents as substitutes for quinine. The slender flexible twigs of some species of *Salix* are in general use for basket-making, and several are extensively cultivated for ornament; of rapid growth, and ready propagation by means of cuttings.

1. **Salix.** Bracts (*scales*) entire. Flowers with small glands; disks none. Stamens few. Stigmas short. Buds with a single scale.
2. **Populus.** Bracts lacerate. Flowers with a broad or cup-shaped disk. Stamens numerous. Stigmas elongated. Buds scaly.

1. SALIX, Tourn. Willow. Osier. (By M. S. Bebb, Esq.*)

Aments preceding or accompanying the leaves, with entire bracts, each flower with 1 or 2 small glands at base. Stamens 2 (very rarely solitary or the 2 wholly connate, in some species 3 to 12); filaments filiform, free or more or less connate; anthers mostly yellow. Ovary and capsule more or less conical; stigmas short, entire or lobed. — Trees, shrubs or undershrubs, mostly confined to the neighborhood of water; branches terete, buds covered with a calyptriform scale, and leaves mostly long and pointed, feather-veined. — Andersson, in DC. Prodr. xvi². 191.

A large and difficult genus of about 160 species, often very variable; about 60 species are North American, the remainder belonging to Europe and extra-tropical Asia, excepting half a dozen found in S. America and S. Africa.

Staminate and pistillate aments on short leafy branchlets.
Trees. Stamens 3 to 5: scales yellowish; those of fruiting ament deciduous.
Petioles not glandular: staminate aments slender, flexuose.
Leaves linear, green on both sides: scales entire or nearly so. 1. S. NIGRA.
Leaves lanceolate, glossy above, glaucous beneath: scales denticulate. 2. S. LÆVIGATA.
Petioles glandular: staminate aments oblong. 3. S. LASIANDRA.

* I would here acknowledge my obligations to Sir Joseph Dalton Hooker and Professor David Oliver for tracings and fragments of rare type-specimens in the Kew Herbarium, which have aided me greatly in the identification of several otherwise very obscure species. — M. S. B.

Shrubs. Stamens 2: scales pale; those of fruiting ament subdeciduous.
Leaves 1 to 3 or 4 inches long.
Stigmas very short, thick: leaves smooth or silky. 4. S. LONGIFOLIA.
Stigmas bifid, with linear lobes: leaves hoary-pubescent. 5. S. SESSILIFOLIA.
Leaves ½ inch long, yew-like: aments short and thick. 6. S. TAXIFOLIA.
Dwarf creeping alpine shrub: scales dark, persistent. 17. S. ARCTICA.
Staminate aments sessile or nearly so; pistillate sessile or on short peduncles, with or without bracts, the scales persistent.
Stamens solitary: scales densely villous: leaves rigid, persistent, densely tomentose beneath. 19. S. COULTERI.
Stamens 2 to each usually dark colored scale.
Capsules glabrous.
Shrub. Leaves finely serrate, soon smooth, paler beneath. 7. S. CORDATA.
Tree or shrub. Leaves unequally subserrate, pubescent, rusty-glaucous beneath. 8. S. LASIOLEPIS.
Capsules tomentose, sometimes glabrous in n. 16.
Style none.
Aments oblong, sessile, appearing before the wedge-obovate leaves. 9. S. FLAVESCENS.
Aments roundish, peduncled, appearing with the silky lanceolate leaves. 10. S. GEYERIANA.
Style evident.
Aments small, roundish: capsules sessile, 1 line long: leaves myrtle-like. 18. S. MONICA.
Aments elongated-cylindrical: capsules sessile, 2 lines long: leaves narrow, sage-like. 14. S. BREWERI.
Aments oblong or cylindrical: capsules more or less pedicelled.
Alpine shrubs, 4–6 feet high. branches short and stout: capsules shortly pedicelled.
Leaves entire. 15. S. GLAUCA.
Leaves glandular-serrulate. 16. S. CALIFORNICA.
Large shrubs, 6–15 feet high: branches slender: capsules pedicelled.
Leaves green above, densely silky-pubescent beneath. 11. S. SITCHENSIS.
Leaves soon glabrate or scarcely pubescent beneath.
Aments preceding the leaves, sessile. 13. S. AUSTINÆ.
Aments produced with the leaves, more or less peduncled. 12. S. LEMMONI.

§ 1. *Stamens 3 to 5: scales yellowish, falling before the maturity of the fertile ament: filaments hairy below. Trees.*

* *Petioles not glandular.*

1. **S. nigra**, Marsh. Trunk slender, often crooked or leaning, with rough dark bark, branches brittle at base; leaves linear-lanceolate, tapering from near the acute base to an extremely long point, often falcate, 4 to 6 inches long, 3 or 4 lines wide, closely serrate, smooth and green on both sides, the midrib prominent; stipules semicordate, often wanting: aments with leafy peduncles, elongated, the fertile becoming rather lax: scales entire or only slightly dentate, villous with crisp hairs: capsules ovate-conical, glabrous, brownish-tawny, more or less pedicelled: styles very short; stigmas slightly notched. — Anders. Sal. Monogr. 19, fig. 15, and DC. Prodr. xvi.². 200.

Growing on the banks of streams and lakes, and bending over the water. Cache Creek, near Clear Lake (*Bolander*); "Sacramento Valley," Wilkes's Exploring Expedition (n. 1234); Fort Mohave, *Cooper*. Collected by *Fremont* in Utah and by *Wright* in New Mexico; not before recorded from west of the Sierra Nevada. Everywhere common between the Gulf of Mexico and the Great Lakes.

2. **S. lævigata**, Bebb. Leaves lanceolate or oblong-lanceolate, acute or acuminate, 3 to 7 inches long and ¾ to 1½ inches wide, the earliest obovate with a mucronate point, glabrous, dark green, glossy and prominently nerved above, paler or glaucous beneath, minutely serrulate; petioles downy, not glandular; stipules semicordate, usually small or none: aments leafy-peduncled, elongated, flexuose, 2 to 4 inches long, rather densely flowered: scales pallid, villous, dentate; in the male

ament roundish-obovate and cucullate, in the female narrower and truncate, with 2 to 4 irregular teeth at the apex: capsule conical from a thick base, acute, glabrous: pedicel 3 or 4 times the length of the nectary: style obsolete or short; stigmas emarginate.

Var. **angustifolia.** Leaves narrower, taper-pointed, falcate, 3 or 4 inches long, 9 lines broad near the roundish base: approaching *S. nigra.*

Var. **congesta.** Aments short, densely flowered, scarcely exceeding the ample leaves of the peduncle: capsules globose-conical, shortly pedicelled.

From San Diego County (*Palmer*) to Sacramento Valley and Sierra County (*Lemmon*); distinguished from *S. nigra* by the broad coriaceous leaves, glossy above and glaucous beneath, and by the dentate scales. The ambiguous variety *angustifolia* was collected by *Rev. E. L. Greene* near Yreka. "An erect pyramidal tree, 15 to 50 feet high, growing on bottom lands near streams: trunk straight, a foot or two in diameter, with fissured dark brown bark." — *Dr. C. L. Anderson.*

* * *Petioles glandular.*

3. **S. lasiandra,** Benth. Leaves lanceolate, taper-pointed, attenuate or roundish at base, smooth, paler or glaucous beneath, margin closely and sharply serrate; petioles glandular at the upper end; stipules semilunar, glandular-serrate, often large and conspicuous, sometimes small or deciduous: aments leafy-peduncled: scales yellowish, thin, more or less dentate, hairy at base or in the female ament somewhat glabrous: stamens 5 or more: capsules lanceolate: style short; stigmas bifid. — Pl. Hartw. 336. *S. Hoffmanniana,* Hook. & Arn. Bot. Beechey, 159. *S. speciosa,* Nutt. Sylva, i. 58, t. 17. *S. arguta* & *lancifolia,* Andersson in DC. Prodr. xvi². 206.

Var. **typica.** Leaves linear-lanceolate, acuminate, attenuate at base: stipules small: scales of the flexuose staminate ament deeply and irregularly glandular-dentate: "branchlets red and leaves darker." — *S. arguta,* var. *lasiandra,* Anders. l. c.

Var. **lancifolia,** Bebb. Leaves tapering regularly from near the roundish or subcordate base to a long attenuate point (sometimes 5 to 7 inches long and 2 inches wide); petioles very glandular; stipules on vigorous young shoots large and glandular-serrate, on flowering branches small and deciduous: scales in the female ament linear, acute, somewhat glabrous, in the male broader, hirsute, and dentate as in the narrow-leaved forms. — *S. lancifolia,* Anders. Sal. Monogr. 34, fig. 23. *S. lucida,* var. *macrophylla,* Anders. in DC. Prodr. xvi². 205, ex descr.

Var. **Fendleriana,** Bebb. Staminate aments thick, densely flowered, on shorter and less leafy peduncles: leaves more coriaceous in texture and green both sides. — *S. pentandra,* var. *caudata,* Nutt. Sylva, i. 61, t. 18. *S. Fendleriana,* Anders. Sal. Bor.-Am. 115. *S. arguta,* Anders. Sal. Monogr. 32, fig. 22.

Sacramento Valley and northward to British Columbia; the var. *Fendleriana* in the Sierra Nevada (*Mrs. R. M. Austin, Lemmon*); also New Mexico (*Fendler*) and Colorado. A tree 20 to 60 feet high, growing along streams: "bark fissured, grayish brown on the trunks of old trees; branchlets shining yellow, drooping: the somewhat straggling stem sends up long branches bearing large leaves near the top, making the tree top-heavy." — *Dr. Anderson.* Nuttall describes the "summit" of the tree as "tufted and spreading." Very near *S. lucida* (especially the var. *Fendleriana*), but the leaves are rather thinner in texture, usually narrower, the male as well as the female aments leafy-peduncled, and the scales distinctly dentate. The Pacific Coast forms have been subdivided into two supposed species, based upon minute characters drawn from the length of the pedicels, form of the scales, capsules, stipules, etc., but these prove to be very unreliable and do not always correspond with each other nor with the form of leaf assigned to each species respectively.

§ 2. *Stamens 2: scales pallid, somewhat deciduous: aments borne on short lateral leafy branches, often clustered: leaves linear to lanceolate, remotely denticulate or entire. Shrubs. Species exceedingly variable and apparently passing into each other.*

4. **S. longifolia,** Muhl. Leaves varying from linear to lanceolate, long-acuminate, tapering at base, sessile or nearly so, 3 or 4 inches long and 1 to 6 (usually 2

or 3) lines broad; margin remotely mucronate-dentate or sometimes entire; stipules very early deciduous: aments linear-cylindrical, borne on lateral leafy branchlets of the season, often clustered at the extremity: scales yellowish, villous, dentate, deciduous: capsules oblong-conical, obtuse, shortly pedicelled, usually tomentose; stigmas large, sessile. — Anders. Sal. Monogr. 54, fig. 35; DC. Prodr. xvi². 214. *S. macrostachya & fluviatilis*, Nutt. Sylva, i. 72, 73.

Var. **argyrophylla**, Anders. Leaves and capsules clothed with a lustrous silky tomentum. — *S. argophylla*, Nutt. Sylva, i. 71, t. 20. *S. brachycarpa*, Nutt. l. c. 69?

Var. **exigua**, Bebb. Leaves narrowly linear, 2 or 3 inches long, less than a line wide. — *S. exigua*, Nutt. Sylva, i. 75.

A frequent and widely distributed species, along streams, rooting extensively in alluvial deposits, usually forming dense clumps, 3 to 15 feet high. Exceedingly variable, especially at the west. From California to Texas, the Saskatchewan, and the Northern States.

5. **S. sessilifolia**, Nutt. Leaves sessile, lanceolate, entire or remotely mucronate-serrate, especially near the very acute apex, grayish tomentose or softly villous on both sides, becoming nearly smooth; stipules acute: aments elongated-cylindrical, densely flowered, terminating short leafy branchlets; scales oblanceolate, villous: capsules more or less tapering from an ovate base, sessile or nearly so, densely pilose when young: style short but distinct; stigmas deeply bifid with linear lobes. — Sylva, i. 68; Anders. Sal. Monogr. 55, fig. 36, and DC. Prodr. xvi². 214.

Var. **Hindsiana**, Anders. Leaves narrowly lanceolate, about an inch and a half long by 1 or 2 lines wide, very acute at each end, entire, opaquely pubescent on both sides: aments short (an inch long), thick and densely flowered: capsules mostly tapering to a beak. — Sal. Bor.-Am. 11. *S. Hindsiana*, Benth. Pl. Hartw. 335; Anders. Sal. Monogr. 56, fig. 37 (poor), and DC. Prodr. xvi². 215; Torrey, Pacif. R. Rep. iv. 138.

The typical form from the northern part of the State and common in Oregon; the variety *Hindsiana* in the Sacramento Valley (*Hartweg, Bigelow, Newberry*), and Coast Ranges from Santa Rosa to Ukiah, *Bolander, Kellogg & Harford*. As here understood *S. sessilifolia* is distinguished from *S. longifolia* mainly by the linear lobes of the stigma. The leaves have a peculiar lanceolate outline and hoary pubescence, but vary much in width, affording no distinction between the more northern broad-leaved type and the variety, which is the prevailing form in California: nor do we find in the shape of the capsules, or aments, any characters which are not equally inconstant.

S. Nevadensis, Watson (Amer. Naturalist, vii. 302), an imperfectly known species of Western Nevada (*Watson, Wheeler*), is a low slender bush with the yellowish silky-pubescent leaves still smaller than in *S. sessilifolia*, var. *Hindsiana*, short slender aments (a half inch long), mostly glabrous scales, and smooth slender ovaries with short thick stigmas. Perhaps a reduced form of *S. longifolia*.

6. **S. taxifolia**, HBK. A shrub, 5 to 6 feet high, with short divaricate branches thickly set with numerous subdistichous yew-like leaves, which are 3 to 6 lines long, a line wide, acute, obsoletely denticulate and silky-pubescent: aments oblong, densely flowered, terminating the branchlets, usually clustered; scales obovate, ciliate on the margin: capsules sessile, ovate-conical: stigmas bifid. — Anders. Sal. Monogr. 57, fig. 38, and DC. Prodr. xvi². 215. *S. microphylla*, Schlect.; Hook. & Arn. Bot. Beechey, 310, t. 70.

"California" (Coulter, n. 651), but the locality is uncertain. It is found in New Mexico (n. 669, Wright), and doubtless occurs within our southern border, being the common species of the *Longifoliæ* group in Mexico.

§ 3. *Stamens* 2: *scales persistent, darker at the apex. Shrubs or small trees.*

* *Capsules glabrous.*

7. **S. cordata**, Muhl. Leaves oblong-lanceolate, acuminate, cordate or acute at base, sharply serrate, glabrous (usually more or less silky when young), paler and reticulate-veined beneath; stipules semilunar, dentate or small and nearly entire: aments leafy at base, cylindrical, the fertile elongating in fruit: scales dark, villous

with long white hairs: capsules ovate-conical, glabrous: pedicel 4 to 7 times the length of the nectary: style short; stigmas bifid. — Anders. Sal. Monogr. 157, fig. 91; DC. Prodr. xvi². 252. *S. lutea*, Nutt. Sylva, i. 63, t. 19.

Var. **Mackenziana**, Hook. Leaves obovate-lanceolate, narrowed at base, subentire; stipules small or none: aments shortly peduncled: pedicels long and slender, much exceeding the small sparsely villous tawny scale. — Fl. Bor.-Am. ii. 149; Anders. l. c. 160, fig. 91* (not good).

Var. **Watsoni**, Bebb. Diffusely branched, the short and divaricate yellowish-green or grayish branches very smooth and polished: leaves smaller, oblong, short-acuminate, 1 to 2 inches long, serrulate or nearly entire: aments 1 inch or less in length, usually crowded. — *S. cordata*, var. (?), Watson, Bot. King Exp. 325.

From the Northern States to the Arctic Coast; frequent through Nevada and Utah, in Colorado and northward, apparently rare in California. Collected by *Bolander* in the Yosemite Valley, and at Yreka by *Greene*: the variety *Watsoni*, peculiar in habit, near Carson City (*Watson*), and in Sierra County, *Lemmon*: the variety *Mackenziana* (easily mistaken for a form of *S. lasiandra*) from Lake County (*Anderson*) and far northward; certainly not a hybrid between *S. cordata* and *S. rostrata* as conjectured by Andersson.

8. **S. lasiolepis**, Benth. Leaves oblanceolate or rarely oblong-oblanceolate, obliquely acute or acuminate, 4 to 6 inches long, ½ to 1 inch wide, the lower spatulate, obtuse, more or less pubescent especially at first, at length glaucous and ferruginous beneath and coriaceous in texture, the margin unequally subserrate; stipules mostly wanting: aments sessile or scarcely peduncled with a few deciduous bracts at base, 1½ to 3 inches long, erect or somewhat flexuose, cylindrical, densely flowered; scales roundish, dark, densely clothed with crisp white hairs: stamens yellow, 3 times the length of the scale; filaments slightly united at base: capsules acute, smooth, dark green, shortly pedicelled: styles medium sized; stigmas short, erect. — Pl. Hartw. 335; Anders. DC. Prodr. xvi². 264.

Var. **Bigelovii**, Bebb. Leaves obovate or cuneate-oblong, obtuse, entire (at least the earliest), grayish silky-pubescent beneath: aments on short and villous often somewhat leafy peduncles: pedicel about the length of the villous scale. — *S. Bigelovii*, Torr. in Pacif. R. Rep. iv. 139; Anders. Sal. Monogr. 163, fig. 94, & DC. Prodr. xvi². 255. *S.* ——? Watson, Bot. King Exp. 325.

Var. (?) **fallax**, Bebb. Leaves lanceolate-oblong, abruptly contracted or even rounded at base, glaucous and pubescent beneath; stipules semilunar, denticulate, persistent: aments smaller and less densely villous.

Throughout the State, from San Diego to Yreka, and in the Sierra Nevada, the commonest of Californian willows and exceedingly variable. In the neighborhood of San Francisco and southward it attains under favorable conditions the height of 40 to 60 feet, but northward and in the mountains at 4,000 feet elevation is reduced to a bush, less than 10 feet high, branching near the ground. Bark smooth, grayish-brown, scarcely fissured even on old trees. Aments appearing before the leaves, or southward, near Los Angeles, etc., in the axils of the persistent leaves of the previous season. *S. Hartwegi*, Benth. (*S. humilis*, var. (?) *Hartwegi*, Anders. l. c. 236), is clearly founded on this serotinous state. Professor Andersson was apparently deceived by the remarkable resemblance which the leaves of this species bear to *S. humilis* when he asserts (l. c.) that he saw *S. humilis* "in California, very common"

* * *Capsules tomentose.*

+ *Styles obsolete.*

9. **S. flavescens**, Nutt. Leaves obovate or oblanceolate, acute or shortly acuminate, only the lower obtuse, wedge-shaped at base, 2 or 3 inches long, 1 to 1½ inches wide, downy but very soon glabrate and dull green above, glaucous and rufous-pubescent beneath or often when young clothed with a compact lustrous silky tomentum; the margin entire or irregularly serrate; stipules semicordate, denticulate: aments sessile, oblong, recurved, densely flowered, appearing before the leaves; scales blackish, obovate, villous with long silky hairs: capsules ovate-lanceolate,

silky-tomentose, on pedicels hardly as long as the scales: styles obsolete; stigmas long, entire or deeply parted, the linear lobes inflexed. — Sylva, i. 65. *S. brachystachys*, Benth. Pl. Hartw. 336; Anders. Sal. Monogr. 82, fig. 48, and DC. Prodr. xvi². 224. *S. stagnalis*, Nutt. Sylva, i. 66? *S. Scouleriana*, Barratt; Hook. Fl. Bor.-Am. ii. 145, in part. *S. capreoides*, Anders. Sal. Bor.-Am. 11.

Santa Barbara (*Mrs. Elwood Cooper*); woods near Monterey (*Hartweg*); also collected by *Coulter*, but the locality uncertain; Santa Cruz Mountains, *Dr. C. L. Anderson*, who says that this willow is "generally found on mountain-sides near springy places and as a kind of undergrowth for trees: old trees, 10 to 20 feet high, have a round bushy top, very straggling and with a profusion of branchlets; bark fissured, brownish-gray; twigs with a very strong mephitic odor at some seasons when bruised." Common through Oregon and British Columbia, and up the coast to Kodiak Island, where it has been collected by *Dr. Kellogg*. The leaves differ much in outline, even the earlier and later of the same bush; at first usually more or less ferruginous-pubescent, but often satiny white-tomentose beneath, and then easily mistaken for *S. Sitchensis*. We follow Andersson in rejecting the older name of the Flora Boreali-Americana, on the ground that *S. Scouleriana*, Barratt, was founded on the leaves of *S. Sitchensis* and aments of *S. flavescens*. Even the "small staminate aments 2 or 3 lines thick," referred to var. *tenuijulis*, by Andersson (DC. Prodr. xvi². 225), from Fort Vancouver (*Tolmie*, in Dr. Gray's herbarium), belong to *S. Sitchensis*, showing not only how easy it is to mix herbarium specimens of these two species, but how far the confusion may be overlooked even by the most critical observers. After Barratt's name there can be no question that the next in point of date is Nuttall's, which is here restored. Recent collections have confirmed the accuracy of his description in some particulars wherein it has heretofore been regarded as ambiguous, excepting however "stigmas pubescent," which still remains unaccountable.

10. **S. Geyeriana,** Anders. Leaves lanceolate, acute at both ends, 2 or 3 inches long by 4 to 6 lines wide, downy above, grayish beneath with soft silky hairs, entire; stipules none: aments at first small, subglobose, nearly equalled by the 3 or 4 silky bracts at their base, becoming short-peduncled in fruit: scales tawny, obtuse, sparsely villous: capsule tapering from an ovate base, silky tomentose: pedicel slender, puberulent, 4 or 5 times the length of the nectary: stigmas sessile, bifid. — Sal. Monogr. 86, fig. 50, and DC. Prodr. xvi². 226.

Sierra County (*Lemmon*); Plumas County (*Mrs. Ames*); Oregon and the Rocky Mountains, *Geyer*. A bush growing on the "borders of streams and rivulets, most abundant about springs, 10 to 15 feet high"; the branchlets usually covered with a glaucous bloom. Mature fertile aments rather more than half an inch long. A beautiful and distinct species, which has been compared with *S. rostrata*; the resemblance is, however, not obvious. It is more nearly allied to *S. petiolaris* or *S. repens*. The leaves bear a cherry-like gall, similar to one that is frequently found on *S. petiolaris*.

++ ++ *Styles evident.*

++ *Usually large shrubs* (6 *to* 15 *feet high*), *but smaller in subalpine regions; branches long and slender.*

11. **S. Sitchensis,** Sanson. A straggling arcuate shrub, 6 to 15 feet high, overhanging streams: branches slender, brownish, downy at first, soon smooth, sometimes covered with a glaucous bloom: leaves oblong-obovate to oblanceolate, acute or the earliest obtuse with an abrupt point, narrowed at base into a short petiole, dark green above except the whitish-pubescent midrib, covered beneath with a lustrous white and satiny tomentum; margin entire or obsoletely crenulate; stipules reniform, usually wanting: aments with a few small bracts at base, erect, slender, densely flowered: scale yellowish or tawny, sparsely villous: capsule ovate-conical, acute, tomentose: pedicel 2 or 3 times the length of the nectary: style elongated: stigmas scarcely emarginate, thick, erect. — Bongard, Veg. Sitch. 162; Anders. Sal. Monogr. 106, fig. 59, and DC. Prodr. xvi². 233. *S. cuneata*, Nutt. Sylva, i. 66.

Var. **angustifolia,** Bebb. Leaves narrowly oblanceolate, acute or acuminate, an inch or two long, 3 or 4 lines wide, the margins entire and revolute; stipules none: mature fertile ament an inch long. — *S. chlorophylla*, var. *pellita*, Anders. in DC. Prodr. xvi². 244.

Santa Barbara (*Mrs. Elwood Cooper*); Santa Cruz (*Anderson*), Bear Valley (*Bolander*), and extending northward to Alaska. A most beautiful and distinct species, remarkable for the silvery under-surface of the leaves. Leaves about an inch broad above the middle: fruiting aments 3 or 4 inches long: style and pedicel of about equal length. Nuttall calls this "Velvet Willow." The variety *angustifolia*, collected on a "high mountain near Donner Pass" by *Dr. Torrey*, 1865, accords essentially (excepting the pointed leaves) with the description of *S. chlorophylla*, var. *pellita*, Anders., though when compared with Dr. Lyall's specimens from the Rocky Mountains, cited by the author, the discrepancy is greater; here we find the leaves 6 to 9 lines or nearly an inch wide, thin and papery in texture, and only the lower spatulate ones obtuse. Similar forms have been collected in Oregon and British America by *Hall* and *Macoun*, appearing like *S. Sitchensis* modified by growing in the shade. Unlike the typical form as Dr. Torrey's specimens appear at first sight, a careful examination fails to afford any distinction not fairly attributable to difference of station.

12. **S. Lemmoni,** Bebb. Branches slender, at first covered with a short appressed pubescence, becoming smooth: leaves lanceolate, acute or acuminate at both ends, entire or remotely subserrate, silky-pubescent, very soon glabrate, paler or scarcely glaucous beneath; petioles slender (4 to 6 lines long); stipules small, semiovate, acute, serrate, deciduous: aments oblong or cylindrical, rather densely flowered, appearing with the leaves, on short peduncles bearing 2 or 3 small acute leaf-like bracts: scales obovate, obtuse or somewhat acute, black, thinly pilose: capsules ovate-lanceolate, acute, grayish-tomentose, 2 or 3 lines long: pedicel 4 to 6 times the length of the nectary: style medium sized; stigmas erect, entire.

Var. **melanolepis.** Scales pitch-black and slightly or not at all hairy.

Var. **macrostachya.** Aments large and soft-villous (resembling those of *S. discolor*): capsules tapering to a produced style: peduncles more leafy.

Var. **sphærostachya.** Aments about half an inch long, subglobose; leaves linear-lanceolate, entire, an inch long. — A divaricately much branched little shrub; seemingly a depauperate or subalpine form.

Sierra County (*J. G. Lemmon*, for whom it is named); Plumas County (*Mrs. Pulsifer Ames, Mrs. Austin*); near Carson City, *Watson*. A shrub rarely attaining the height of 15 feet, with smooth olive-colored bark on the older branches. It exhibits much diversity in the character of the aments, but the different forms apparently pass into each other throughout the series, and the leaves furnish no distinctions. *S. macrocarpa*, Nutt., a little known species from Oregon, differs especially in its smaller pale acute scales, glabrate capsules, and nearly sessile stigmas. Among Dr. Bolander's specimens from West Falls Meadows, 7,000 or 8,000 feet altitude, we find staminate aments in which the filaments are united nearly to the anthers and unusually pubescent. The material is too scanty to warrant more than a conjecture that this may be a *forma monstrosa* of *S. Lemmoni*.

13. **S. Austinæ,** Bebb. A shrub or small tree, with very smooth light-gray bark; recent branches slender and but little divided, shining yellow or bronzed, very tough: leaves narrowly oblanceolate, obliquely acuminate or falcate, attenuate at base, smooth and bright green above except the yellowish midrib, glaucous and pubescent beneath, the margin very slightly and obscurely subserrate; stipules none: aments appearing before the leaves, sessile, the small bracts at base early deciduous, erect, cylindrical-oblong, densely flowered; scales obovate, dark, clothed with silky hairs: capsules tapering to a beak, tomentose, about 2 lines long, shortly pedicelled so that they are partially covered, even when mature, by the scales: styles produced; stigmas erect, entire.

Indian Valley, Plumas County, *Mrs. E. M. Austin*, — who in doing much to advance our knowledge of the botany of the Sierra Nevada has not neglected the Willows. Aments somewhat as in *S. fulcrata*, Anders., but that has proportionately shorter and broader leaves, "scarcely 2 inches long by ¾ to 1 inch broad," thinner in texture and dull green above, and large serrulate stipules. The figure given by the author (Monogr. fig. 73) corresponds neither with his description nor with a sketch of Seemann's specimen (in Herb. Kew) on which the species was founded.

14. **S. Breweri,** Bebb. Branches long, very slender and pliant, pubescent at first, becoming smooth: leaves linear-lanceolate, acute or acuminate, sessile or nearly

so, 2 or 3 inches long by 3 or 4 lines wide, at first downy above especially along the whitish midrib, at length glabrate and dull green, beneath glaucous, pubescent and prominently rugose-veined; the margin undulate-entire or remotely and unevenly glandular-dentate; stipules small, lanceolate, acute: fertile ament sessile, with two or three small bracts at base, elongated, slenderly cylindrical, densely flowered, with thickish pubescent rhachis; scales spatulate, pale, scantily villous: capsules short-conical from a gibbous base, acute, tomentose, sessile, 2 lines long: styles elongated, slender; stigmas spreading, bifid: nectary linear or filiform, nearly as long as the scale.

On San Carlos Mountain in a dry ravine, at 3,500 feet altitude, *W. H. Brewer.* An interesting discovery of a genuine American representative of the *Viminales*, — a group widely distributed throughout Europe and Russian Asia (except in the extreme north), in the temperate regions of India, and in Japan. Our plant, the leaves of which resemble those of *S. salviæfolia*, Link, is abundantly distinguished from all the forms of the Old World.

++ ++ *Alpine shrubs, 4 to 6 feet high, with short and stout branches, or dwarf and procumbent or creeping.*

15. **S. glauca**, Linn. Leaves elliptic-lanceolate, usually silky-villous both sides, obscurely glaucous beneath, entire: aments leafy-peduncled, cylindrical, rather thick, somewhat densely flowered: scales subacute or obtuse, tawny at base and darker above, villous with long white hairs: capsules ovate-lanceolate, rather obtuse, densely white-tomentose, scarcely or shortly pedicelled: pedicel equalling the nectary: style produced, usually bifid; stigmas laciniate, divaricate. — Anders. in DC. Prodr. xvi². 280.

Var. **villosa**, Anders. A diffuse shrub, 3 to 7 feet high, with short and stout branches: leaves oblanceolate, acute or short acuminate, attenuate at base, 2 to 4 inches long, varying from soft villous to scarcely pilose when young, at length glabrate and rigid, more or less glaucous beneath; stipules linear-lanceolate ("semicordate," Hook.), rather persistent: aments short-peduncled, the fertile when mature sometimes very large, 2 or 3 inches long, ¾ inch thick; scales oblong-obovate, rather acute, brownish: capsules lanceolate-acuminate, tomentose, at length subglabrate, shortly pedicelled: style short or scarcely produced; stigmas bifid or entire. — Sal. Bor.-Am. 22. *S. villosa*, (Don?) Hook. Fl. Bor.-Am. ii. 144. *S. glaucops*, Anders. in DC. Prodr. xvi². 281.

The genuine *S. glauca* has not been found, and probably does not occur, within our boundaries. The variety *villosa*, collected in the Sierra Nevada at from 9,000 to 12,000 feet altitude (*Brewer, Bolander, Rothrock*), ranges northward in the mountains to British Columbia and to the Saskatchewan. This comprehends a number of forms differing from *S. glauca* mainly in their less tomentose and more pointed capsules, entire styles, and less deeply cut stigmas: subsequently interposed by Andersson as a quasi-species between *S. glauca* and *S. desertorum*.

16. **S. Californica**, Bebb. Usually 4 to 6 feet high: leaves lanceolate to obovate, acute, 1½ to 3 inches long by 4 to 7 lines wide, abruptly contracted or even rounded at base, glandular serrulate, villous-tomentose when young, at length glabrate and green both sides; stipules lanceolate, acute, serrulate: aments cylindrical, densely flowered, appearing with the leaves, when in flower about an inch long, the fertile when in fruit lengthening to 2 inches or more; the leaf-like bracts at base closely studded on the margin with minute glands: scales lanceolate, acute, dark, villous with long silky hairs: capsule ovate-conical, rather obtuse, grayish-tomentose, 2 or 3 lines long: pedicel short but distinct, about the length of the nectary: style elongated, entire; stigmas mostly entire, erect.

This occurs in the Sierra Nevada at lower altitudes (8,000 to 9,000 feet) than the preceding, from Mariposa County northward (*Brewer, Bolander, Lemmon, Greene, Mrs. Austin*). Easily distinguished from genuine *S. glauca* by the glandular-serrulate leaves, elongated entire styles, and shorter erect mostly entire stigmas; but some of the forms are not so clearly separable from the variety *villosa*. It is an evident transition toward *S. adenophylla* (shores of the Great Lakes, Labrador, etc.), the staminate aments, with glandular-margined bracts at base, being very much

as in that species. *S. subcordata*, Anders., similarly distinguished from *S. glauca*, differs in its orbicular-oval leaves and large semicordate denticulate stipules.

17. **S. arctica**, Pallas. Leaves obovate, oval, or spatulate-lanceolate, entire or obsoletely and remotely serrate, at length smooth, glaucous beneath: aments lateral and somewhat terminal, upon long strict leafy peduncles, erect, rather thick and densely flowered: scales obovate, obtuse, pale or dark colored, pilose: capsule conic from an ovate base: style medium sized, becoming brown: stigmas divaricately parted. — Anders. in DC. Prodr. xvi². 286; Watson, Bot. King Exp. 326.

Var. **petræa**, Anders. l. c. A dwarf creeping shrub, with suberect branches leafy at the top, only 2 to 4 inches high, though often covering considerable surface: leaves lanceolate, tapering somewhat equally to the base and apex (an inch long by 3 to 6 lines wide), entire, green on both sides, slightly paler and prominently nerved beneath: aments terminal, erect, at length thick and densely flowered, an inch or two long: scales thin, brownish, sparsely pilose: capsules ovate-conical, 2 or 3 lines long, silky, subsessile, the nectary rather exceeding the base of the capsule: style very much elongated, slender: stigmas bifid, divaricate.

In various forms from Greenland and Labrador to Alaska. The variety *petræa* in the Sierra Nevada at 9,000 to 11,000 feet altitude (*Anderson, Brewer, Bolander, Lemmon*), and also on alpine summits of the Rocky Mountains from Colorado, where it is frequently collected, northward to British America (*Bourgeau, Lyall*); an alpine form of the species, and the only one known to occur within the boundaries of the United States.

18. **S. Monica**, Bebb. A small alpine shrub, profusely branched, procumbent but not creeping; branches smooth: leaves oblanceolate or oblong, ½ to 1 inch long, 3 or 4 lines wide, acute at both ends, or the lower obtuse, entire or obscurely serrate, glabrous, bright green and with regularly radiating parallel impressed nerves above, paler but not glaucous beneath; stipules none: aments lateral, diminutive, roundish, densely flowered, sessile or on very short but distinct peduncles, with two oblong leaf-like bracts at base; scales in the fertile ament roundish-ovate, rather obtuse, dark colored and slightly villous, in the staminate ament lingulate, much narrower, longer, paler, very acute and nearly smooth: filaments long; anthers after flowering brownish: capsules minute, a line long, ovate-conical, silky-tomentose, sessile: styles medium sized, not produced; stigmas mostly entire, spreading.

Mono Pass summit; June, *Bolander*. A clear species of the *Myrtosalix* section; differing widely from *S. tenera*, Anders. (from the Cascade Mountains, 7,000 feet altitude, *Lyall*), with which alone it can be compared, — that having gracefully slender aments terminating lateral branches, lingulate leaves, and the relative form of the scales of the male and female aments singularly reversed, as it were, from what they appear in *S. Monica*.

§ 4. *Stamen solitary. Aments thick, densely villous, appearing in the axils of the rigid persistent leaves.* (*A purely arbitrary and provisional arrangement.*)

19. **S. Coulteri**, Anders. Recent branches very stout, furrowed, and densely grayish-tomentose: leaves crowded, thick and becoming rigid, oblong, about two inches long by an inch wide, acute at each end, dull green and glabrate above except the whitish impressed midrib and nerves, beneath very densely clothed with a soft persistent white tomentum, the margin revolute and entire; petioles short and stout, dilated below and embracing the large roundish obtuse silky buds; stipules varying from reniform to lanceolate with an oblique point: staminate aments sessile [always?], cylindrical, erect, densely flowered; scales spatulate, pale, densely villous with very long silky hairs, which conceal the filament of the single stamen found under each scale.

Known only from staminate aments collected by *Coulter*, but locality uncertain, and by *Bolander* near San Francisco ("a single tree, 15 feet high; common in Marin County"). In one specimen the aments (about an inch long) appear in the axils of the persistent leaves. The dense woolliness of the under surface of the leaves is dull white rather than silky, at length apparently ferruginous, disappearing only from the prominent midrib.

2. POPULUS, Tourn. Poplar. Cottonwood. Aspen.

Aments preceding the leaves, pendulous, axillary, sessile or nearly so, the pistillate longest and loosely flowered: bracts lacerately toothed or fringed. Stamens few to many, inserted on the face of an obliquely truncate disk, with distinct filiform filaments and purple anthers. Ovary surrounded by a more or less cup-shaped disk: styles 2 to 4, often united at base, lobed or divided. Capsule ovate-oblong to globose, 2–4-valved. — Trees with scaly and often resinous buds, caducous stipules, and glandular-crenate leaves. — Wesmael in DC. Prodr. xvi². 323.

About 20 species, of northern extra-tropical regions, equally divided between the Old and New Worlds. The wood is light-colored, soft and light, durable if kept dry. The fragrant resinous balsam, which coats abundantly the buds of some species, is occasionally collected for medicinal use.

* *Styles 2, with 2 or 3 linear lobes: capsules small, oblong-conical, thin, 2-valved: stamens 6 to 20: leaves broadly ovate, crenulate; petioles flattened.*

1. **P. tremuloides,** Michx. Trunk straight and slender, 20 to 50 feet high, with smooth grayish-white bark; branches not angled: buds long, viscid: leaves round-ovate, 1 to 3 inches in diameter, very shortly acuminate, slightly cordate to somewhat cuneate at base, villous-ciliate when young; petioles slender, much flattened above, as long as the blade: staminate aments dense, an inch or two long, with long-ciliate bracts: stamens 7 to 10, with very short filaments: pistillate aments 2 to 4 inches long, the rhachis pubescent: disk small: capsules on short slender pedicels (a half to one line long), glabrous, 2 lines long: seed light brown, a half line long. — Michx. f. Arb. Amer. iii. 285, t. 8, fig. 1.

From the Sacramento eastward across the continent and northward through British America to the Arctic Ocean; in the Rocky Mountains as far south as New Mexico. Usually in dense copses, covering moist slopes and bottoms, at an altitude varying from 6,000 to 10,000 feet or more. Generally known as "Quaking Asp."

* * *Styles 2 to 4, with dilated lobes: capsules large, subglobose to ovate-oblong, 2–4-valved, often thick.*

+– *Stamens usually 20 to 30: leaves cordate or ovate to lanceolate, crenate; petioles terete: seed a line long: young bark brownish.*

2. **P. trichocarpa,** Torr. & Gray. A tree of open growth, 30 to 50 feet high or more, with thick cracked bark, the young barren branches somewhat angled: buds shining and viscid: leaves broadly ovate to oblong-lanceolate, acuminate, cordate (sometimes rounded) at base, 2 to 4 inches long, finely puberulent when young, becoming somewhat lighter colored beneath; petioles usually an inch or two long: staminate aments dense, 2 inches long; bracts slightly villous; rhachis pubescent; disk broad, somewhat pubescent; filaments as long as the anthers: pistillate aments 2 inches or more (becoming 6 inches) long, with pubescent rhachis, the bracts and much dilated disk nearly glabrous: ovary densely pubescent; styles 3, broadly dilated and lobed: capsules nearly sessile, subglobose, pubescent, 3-valved, 3 lines in diameter: seed light-colored. — Hook. Icon. t. 878; Watson, Bot. King Exped. 328, and Amer. Journ. Sci. 3 ser. xv. 136. *P. balsamifera,* var. γ, Hook. Fl. Bor.-Am. ii. 154. *P. balsamifera,* var. (?) *Californica,* Watson, l. c. 135.

Var. **cupulata,** Watson, l. c. 136. Disk of the pistillate flowers very large and somewhat herbaceous, campanulate and twice longer than the ovary, pubescent: bracts somewhat villous, and pedicels a line or two long.

From San Diego northward to British Columbia and extending into Western Nevada: the variety from Plumas County, *Mrs. Austin.* According to Douglas it attains in Washington Territory a height of 60 to 100 feet, with a diameter of 2 to 6 feet. Like the following species it is generally found scattered or in open groves along stream-banks and in river bottoms, at an altitude not exceeding 6,000 feet. The narrow-leaved species of the Rocky Mountains (*P. angustifolia,* James) is found in the mountains of Central Nevada (Shoshone Mountains, *Watson*), and northwestward to the valley of the Columbia.

++ ++ *Stamens* 60 *or more: leaves deltoid, sinuately crenate; petioles flattened: seeds* $1\frac{1}{2}$ *or* 2 *lines long: young bark yellowish, becoming light gray.*

3. **P. Fremonti**, Watson. A large tree, with gray cracked bark and terete branches: leaves broadly deltoid or often somewhat reniform, with a broad acute apex and usually more or less of a sinus at base, few serratures (4 to 12 on each side), and petioles 1 to $2\frac{1}{2}$ inches long; the petioles, branchlets, and margins of the leaves often with short spreading pubescence when young: aments with glabrous rhachis and bracts; the staminate loose, with pedicels 8 to 10 lines long and conspicuous disks 3 or 4 lines broad: styles 3: fruiting aments 3 or 4 inches long: capsules ovate, 3 or 4 lines long, on short stout pedicels (a line or two long), the disk 3 lines broad; valves 3, thick-coriaceous: seeds white. — Proc. Am. Acad. x. 350 and l. c. 136. *P. monilifera*, Newberry, Pacif. R. Rep. vi. 89; Watson, Bot. King Exped. 327.

Var. (*l*) **Wislizeni**, Watson, l. c. 137. Leaves sharply acuminate, truncate or slightly cuneate at base: staminate aments with shorter pedicels and less dilated thin disks; pistillate aments very slender, 2 to 6 inches long: disk 2 or 3 lines broad: capsules ovate to ovate-oblong, somewhat angled, 3- or usually 4-valved, 4 or 5 lines long, on slender pedicels 2 to 8 lines long. — *P. monilifera*, Torrey, Bot. Mex. Bound. 204, etc.

The typical form of the species is found on the Upper Sacramento River and eastward in Nevada and to S. Utah (*Palmer, Parry*); the variety is the prevalent Cottonwood in the more southern districts, ranging from San Diego County (Jamul Valley, *Palmer*) and the Colorado Valley (Ft. Yuma, *Schott*) to S. Utah and the Rio Grande.

Order XCIV. JUGLANDACEÆ.

Monœcious trees or shrubs, with alternate pinnate leaves without stipules, sterile flowers in aments with usually numerous stamens and a 3 – 6-lobed perianth adnate to a bract, fertile flowers solitary or few and spicate, with a 2 – 5-lobed (sometimes double) perianth more or less adherent to the 1-ovuled 1-celled (at length imperfectly 2 – 4-celled) ovary, and a fleshy indehiscent or 4-valved fruit containing a bony nut and a large exalbuminous 2 – 4-lobed orthotropous seed. Stamens with very short filaments and the connective usually prolonged. Style short; stigmas 2 – 4-lobed. Embryo fleshy and oily, covered by a membranous testa; radicle very short, superior.

The principal genera are *Juglans* and *Carya*, almost wholly North American, the latter including the Hickory and Pecan Nuts of the Atlantic States. Three other small genera are Asiatic. The total number of species is 25 or 30.

1. JUGLANS, Linn. Walnut.

Staminate aments from the previous year's wood, long, solitary or in pairs; perianth unequally 3 – 6-lobed; stamens 12 to 40. Fertile flowers solitary, or few in a short terminal spike, the calyx adherent to the ovary, 4-toothed and with 4 small petals. Style short; stigmas 2, linear or clavate, fringed. Pericarp fleshy, indehiscent, enclosing an irregularly rugose nut, 2-valved in germination. — Trees or large shrubs, with somewhat resinous-aromatic bark and foliage, nearly naked buds, and unequally pinnate leaves of many serrate leaflets; pith in plates.

Including the Black Walnut (*J. nigra*), very valuable and extensively used for cabinet pur-

poses, the Butternut (*J. cinerea*), both of the Atlantic States, the English Walnut (*J. regia*), a native of Asia but long cultivated throughout temperate Europe, and four or five other less known species.

1. **J. Californica,** Watson. More or less tomentose, sometimes nearly glabrous: leaflets 5 to 8 pairs, oblong-lanceolate, acute, narrowing upward from near the base, 2 to 2½ inches long: aments often in pairs, 4 to 8 inches long, loose: lobes of the perianth in the staminate flowers 1½ lines long, acute or obtuse, veined: stamens 30 to 40; anthers a line long, with the apex of the connective very short and bifid: fruit globose, slightly compressed, ¾ to 1 inch in diameter: nut shallowly sulcate, the walls rather thin, with 2 broad cavities upon each side. — Proc. Am. Acad. x. 349. *J. rupestris*, var. *major*, Torrey in Sitgr. Rep. 171, t. 16.

A tree or large shrub, in the vicinity of San Francisco and along the Sacramento (where it is sometimes cultivated) growing to the height of 40 to 60 feet, and 2 to 4 feet in diameter; ranging southward to Santa Barbara, and eastward through Southern Arizona to New Mexico and Sonora, *Thurber*.

J. RUPESTRIS, Engelm. Sitgr. Rep. 171, t. 15, is smaller (6 to 20 feet high), with more numerous (6 to 12 pairs) and usually more acuminate leaflets; aments only 2 inches long, with smaller perianth, 20 to 30 stamens, shorter anthers and more prominent connective; nut globose, 6 or 7 lines in diameter, with very thick nearly solid walls. Frequent in Texas and New Mexico; Walnut Grove, Arizona, *Palmer*.

Order XCV. CUPULIFERÆ.

Monœcious trees or shrubs, with alternate simple pinnately veined leaves, caducous stipules, staminate flowers naked or bracteate, in cylindrical or globose aments, with a lobed or cleft perianth, and the pistillate sessile in a cup-like involucre (1 – 5-flowered) covered with bractlike or spinescent appendages, with 6-lobed perianth adherent to the 2 – 6-celled and 4 – 12-ovuled ovary, which becomes a 1-celled 1-seeded nut seated in or covered by the enlarged involucre. Stamens 4 to 20, with distinct filaments and 2-celled anthers. Styles 2 to 6. Ovules erect or pendulous, anatropous, usually all but 1 abortive though persistent. Seed without albumen; testa double. Embryo straight, with small superior radicle, and fleshy cotyledons.

A most important order, though including but four genera, extensively distributed especially through northern temperate regions. The Chestnut (*Castanea*) and Beech (*Fagus*) occur in North America only in the Atlantic States; the former also represented in the Old World by a single species, and the latter by a few scattered species in Europe, Japan, South America, New Zealand and Australia.

1. **Quercus.** Involucre 1-flowered, scaly and entire, becoming a cup.
2. **Castanopsis.** Involucre 1 – 3-flowered, becoming a hard prickly bur.

1. QUERCUS, Linn. Oak. (By Dr. George Engelmann.)

Staminate flowers in slender aments; bracts mostly caducous: calyx 4 – 8-parted or -lobed: stamens 3 to 10; anthers 2-celled. Pistillate flowers single or in clusters or sometimes in spikes, consisting of an incompletely 3-celled 6-ovuled ovary, bearing three styles or sessile stigmas, and enclosed by a scaly bud-like involucre which enlarges into an indurated cup (*cupule*) around the base of the single rounded or elongated 1-seeded nut or acorn, the 5 undeveloped ovules remaining as rudiments at the base or top of the perfect seed. Cotyledons continuing underground in germination; radicle very short and included. — Flowers greenish, developing with the

leaves. Very large trees, or sometimes shrubs. — Engelmann, Trans. St. Louis Acad. iii. 372.

A large and difficult genus of about 250 species, distributed throughout the temperate and warm regions of the northern hemisphere, especially abundant in Eastern Asia and in Mexico. Of the 40 species found within the limits of the United States, 25 are limited to the region eastward of the Rocky Mountains. A single species (*Q. undulata*) is found in Colorado and Utah, ranging also into S. California, all the other Californian forms, excepting *Q. oblongifolia* of the southern border, being peculiar to the Western Coast. One other species (*Q. Emoryi*) belongs to Arizona and New Mexico, but does not enter California. The wood of the genus is mostly hard and durable, and most valuable for its economic uses. The bark also, from the amount of tannin which it contains, is extensively used in the manufacture of leather.

Staminate aments pendulous, below the pistillate flowers: filaments not longer than the anthers: stigmas dilated.
- Abortive ovules at the base or side of the seed: stamens 6 to 8: stigmas subsessile: bark light-colored.
  - Acorns glabrous within, maturing the first year.
    - Leaves deciduous: large trees, with large acorns.
      - Branches slender, glabrous: leaves deeply lobed, 4 inches long or less: buds oval, small: nut long-conical. — 1. Q. LOBATA.
      - Branchlets thicker, pubescent: leaves larger, rougher: buds large, lanceolate, tomentose: nut ovate. — 2. Q. GARRYANA.
      - Branchlets pubescent: leaves less lobed, 1 or 2 inches long: buds small, oval, slightly pubescent: nut long-oblong. — 3. Q. DOUGLASII.
    - Leaves deciduous, small, deeply lobed: a shrub with slightly pubescent branchlets: buds oval, subpubescent: nut oval. — 4. Q. BREWERI.
    - Leaves persistent, coriaceous, small.
      - Shrub: leaves broadly oval, 1 inch long, spinosely lobed-dentate: cup 3 or 4 lines wide: nut elongated, slender. — 5. Q. UNDULATA.
      - Shrub or small tree: leaves oblong, ½ to 1 inch long, entire or sinuate or spinose-toothed: cup 4 to 10 lines wide: nut oval. — 6. Q. DUMOSA.
      - Small tree: leaves oblong, 1 or 2 inches long, entire or with few blunt teeth: nut oblong. — 7. Q. OBLONGIFOLIA.
  - Acorns biennial, pubescent or (in n. 10) tomentose within: leaves persistent, coriaceous.
    - Large tree or shrub: leaves oblong, 1 or 2 inches long, entire or sharply-toothed: cup yellow-tomentose, often very thick, hemispherical: nut oval, obtuse. — 8. Q. CHRYSOLEPIS.
    - Tree: leaves oblong-lanceolate, 2 or 3 inches long, crenate-dentate, strongly ribbed: nut ovate, in a shallow cup. — 9. Q. TOMENTELLA.
    - Shrub: leaves round-oval, rigid, 1 inch long or less, spinose-dentate: cup turbinate. — 10. Q. PALMERI.
- Abortive ovules at top of the seed: anthers 4 or 5: styles long: nuts tomentose within: bark dark: leaf-lobes setaceously mucronate.
  - Acorns annual: leaves subpersistent.
    - Large tree or shrub: leaves oblong to orbicular, 2 or 3 inches long, sinuately spinose-dentate: cup turbinate: nut elongated, acute. — 11. Q. AGRIFOLIA.
  - Acorns biennial.
    - Tree or shrub: leaves persistent, strongly reticulated, dark green and shining, entire to spinosely sinuate-lobed; petioles short: cup turbinate, very deep: nut slender, acute. — 12. Q. WISLIZENI.
    - Tree or shrub: leaves deciduous, pinnatifid-lobed; petioles long: cup hemispherical: nut oblong, obtuse. — 13. Q. KELLOGGII.

Aments erect, pistillate at base or wholly staminate: filaments elongated: stigmas linear: fruit biennial: leaves persistent. — 14. Q. DENSIFLORA.

§ 1. *Staminate aments naked, from last year's buds or from the lower part of this year's shoots, pendulous; filaments not longer than the anthers; pollen large* (.015–.020 *lines in diameter*): *pistillate flowers above the staminate aments, from the axils of young leaves; stigmas dilated.* — LEPIDOBALANUS, Endl.

* *Abortive ovules at the base or rarely at the side (in n. 8) of the seed: stamens 5 to 10 (usually 6 to 8): stigmas sessile or subsessile. Bark usually light-colored: wood dense and durable.* — WHITE OAKS.

\+ *Acorns maturing in the first season, glabrous within.*

\+\+ *Leaves deciduous.*

1. **Q. lobata,** Née. A large stately tree, with glabrous slender often pendent branches: leaves pubescent beneath, oblong or obovate, deeply lobed or pinnatifid, usually 2½ to 3 or rarely 4 inches long, on short petioles (2 to 6 lines long); lobes obtuse, retuse, or sometimes lobe-dentate: calyx with 6 or 8 triangular-lanceolate pubescent and ciliate lobes, bearing as many orbicular anthers: acorns subsessile; nut elongated-conical (1¼ to 2¼ inches long), usually pointed; cup deeply hemispherical, almost always strongly tuberculated. — Ann. Cienc. Nat. iii. 278; A. DC. Prodr. xvi². 24; Torr. Bot. Wilkes Exped. t. 15; Engelm. l. c. 388. *Q. Hindsii,* Benth. Bot. Sulph. 55; Newberry, Pacif. R. Rep. vi. 29, t. 1 and fig. 7. *Q. Ransomi,* Kellogg, Proc. Calif. Acad. i. 25 ?

Common throughout the State, on the plains and in the foothills, or in the southern part of the State somewhat higher in the mountains. A majestic tree, sometimes 15 or 20 feet in girth, 100 feet high, and with a wider spread of branches (*Brewer*), which often hang down to the ground: bark gray and in old trees often 4 or 5 inches thick: winter-buds oval, only about 2 lines long, pubescent on the edges of the bright brown scales: young leaves canescent on both sides. The wood is said to be brittle. "Roble" of the Mexicans.

2. **Q. Garryana,** Dougl. A large tree, with thicker more rigid tomentose or pubescent branchlets and coarser foliage: leaves 4 to 6 inches long by 2 to 5 inches wide, on petioles ½ to 1 inch long, coarsely lobed-pinnatifid; lobes broad, obtuse or sometimes acutish, entire or again notched or lobed, dull-green above, beneath strongly reticulated, pale or yellowish, and somewhat pubescent: calyx-lobes 7 or 8, linear-lanceolate, ciliate: anthers 6 or 8: acorns sessile or shortly peduncled; nut oval, often ventricose, obtuse, 1¼ to 1½ inches long; cups small and very shallow, with small lanceolate slightly pubescent scales, or sometimes thicker with inflated scales. — Hook. Fl. Bor.-Am. ii. 159; Nutt. Sylva, i. 1, t. 1. *Q. Neæi,* Liebm. Dansk. Vidensk. Selsk. Forhandl. 1854, 173.

A common oak of the lower country and in the valleys north of San Francisco Bay, extending into Oregon and to British Columbia, where it is the only species. It is a large tree, often 10 or 12 feet in circumference and 60 or 70 feet high (*Brewer,* or even 100 feet high according to *Nuttall*), with hard but, it is said, brittle wood: bark thinner than in the last, only 1 or 1½ inches thick even in large trees. This species has often been confounded with the last and with the following species, but the thick strongly reticulated leaves, and especially the large lanceolate and densely tomentose winter-buds (4 or 5 lines in length), are characteristic and readily distinguish it.

3. **Q. Douglasii,** Hook. & Arn. A rather large tree, with pubescent branchlets: leaves smaller (usually only an inch or two long), oblong, sinuate or with shallow lobes or sometimes almost entire, on short petioles (3 lines long), bluish-green and at last glabrate above, pubescent beneath: acorn sessile or on a short peduncle; cup hemispherical, with ovate-lanceolate flat rarely tubercled scales; nut long-oblong (¾ to 1¼ inches long), mostly tapering and acutish. — Bot. Beechey, 391; Hook. Icon. t. 382, 383; Nutt. Sylva, i. 10, t. 4.

On dry foothills of the Coast Ranges, from Monte Diablo and Mount Oso to Sacramento Valley, but not observed in the extreme northern or southern parts of the State. A fine tree, but smaller than the last, and known as the Mountain White Oak or Blue Oak. It resembles a middle-sized White Oak of the Eastern States (*Q. alba*) in its size, pale scaly bark, and quality of its timber. The largest trees seen by Professor Brewer had a circumference of 9 feet. The winter-buds are oval, about 2 lines long, reddish brown and only slightly pubescent. The three preceding species have often been confounded and certainly vary much in the size and shape of the leaves and acorns (both nuts and cups), but they are believed to be well-distinguished species, always recognizable by the characters above enumerated.

4. **Q. Breweri,** Engelm. A shrub 2 to 6 feet high, with slightly pubescent branchlets, at last glabrate: leaves small (1½ to 2 or rarely 3 inches long), deeply pinnatifid; lobes obtuse (rarely acutish) and emarginate, sometimes again lobed, on petioles 2 or rarely 3 lines long: acorns sessile or on peduncles 6 to 9 lines long; cups rather shallow, mostly strongly tuberculate; nuts oval, obtuse, an inch or more in length. — *Q. lobata,* subsp. *fruticosa,* Engelm. l. c. 389.

On the middle or higher elevations of the Sierra Nevada, from Calaveras County to the Oregon line, forming "oak-chapparal." The foliage greatly resembles that of *Q. lobata,* the acorns rather those of *Q. Garryana,* and the oval brown slightly pubescent winter-buds, only 1 to 1½ lines long, are similar to those of *Q. Douglasii.*

++ ++ *Leaves persistent through winter and mostly until the appearance of new leaves.*

5. **Q. undulata,** Torr., var. **pungens,** Engelm. l. c. 392. A shrub 2 to 8 feet high, much branched and of scraggy habit: leaves small (an inch long), broadly oval, spinosely lobe-dentate, rarely nearly entire, coriaceous, pale green, on very short petioles, pubescent or hoary beneath, mostly glabrate above: aments short (¾ to 1 inch long), woolly: calyx with 5 oval lobes and 5 to 8 (usually 6) small orbicular anthers: acorns sessile or pedunculed; cups mostly hemispherical, only 3 or 4 lines in diameter; nut slender, elongated, 6 to 10 lines long. — *Q. pungens,* Liebm. l. c. 171, in part.

In the California Desert (*Dr. Parry*), the western limit of this variety, which is very common in Arizona and eastward. I take this to be an extreme form of *Q. undulata* of the Rocky Mountains, the large-leaved variety of which (var. *Gambelii*), with dark green obtusely lobed deciduous leaves, has not yet been found so far to the southwest. The acorns are sweet and edible.

6. **Q. dumosa,** Nutt. A tall shrub or small tree, 4 to 10 or 20 feet high, mostly with slender straight branches, woolly when young: leaves coriaceous, mostly small (a half-inch to an inch long, or rarely larger), on petioles a line or two long, oblong, obtuse, rounded or rarely acute at base, entire or usually sinuate or sinuate-toothed, on young shoots spinose-toothed, dark green above, pubescent beneath, the margins rather revolute: aments about an inch long: calyx with 5 to 8 ovate-lanceolate pubescent lobes and as many stamens: acorns sessile, exceedingly variable in size; cups deeply hemispherical, 4 to 10 lines wide, dark-colored and usually strongly tubercled, rarely with rather flat scales; nuts oval, an inch long or more, sometimes slender and smaller. — Sylva, i. 7; Engelm. l. c. 393. *Q. berberidifolia,* Liebm. l. c. 172, in part. *Q. acutidens,* Torr. Bot. Mex. Bound. 207, t. 51, a large-leaved form.

Var. **bullata.** Leaves rounder, thicker, paler, convex above, hoary on both sides or only below.

Common in the cañons and on the arid slopes of the Coast Ranges from San Diego to San Francisco Bay; the variety in the Santa Lucia Mountains (*Brewer*) and northward to Lake County, *Dr. Torrey.* Closely allied to the last and frequently confounded with it, but occupying a different geographical area and bearing very different fruit. The leaves also are much less spiny, except on young shoots, and more sinuate or sinuate-toothed. The variety has a peculiar aspect, but can hardly be separated specifically. It appears to extend farther north than the principal form.

7. **Q. oblongifolia,** Torr. A middle-sized tree, 20 to 30 feet high, with pale smoothish bark, as in *Q. alba:* leaves oblong, 1 or 2 inches long and half as wide, on very short petioles (a line or two long), entire or with a few blunt teeth, obtuse at each end or subcordate at base, at first soft-downy, the older ones entirely glabrous, coriaceous and almost without reticulation: calyx-lobes short, oval, woolly: acorns sessile or pedunculed; cups hemispherical, tubercled; nuts oblong, ½ to 1 inch long. — Sitgreaves' Rep. 173, t. 19; Engelm. l. c. 393.

In the mountains of Southwestern California, from San Diego to Los Angeles, and eastward into Chihuahua and New Mexico; known as the Evergreen White Oak or Live Oak. The

wood is said to be hard but brittle. A beautiful tree, 2 to 2½ feet in diameter (*Brewer*), with the aspect of the eastern Live Oak. Young shoots have acutely dentate leaves, and a specimen from San Gabriel (n. 114, *Brewer*) has very large ones, 3 inches long and half as wide. *Q. oblongifolia* of Bot. Mex. Bound. 206 is principally *Q. undulata*, var. *grisea*.

+ + *Acorns maturing the second season, the nuts often pubescent or tomentose (in n. 10) within: leaves persistent.*

8. **Q. chrysolepis,** Liebm. l. c. 173. One of the largest oaks (on the higher mountains often low and shrubby), with flaky ash-gray bark: leaves oblong, acute or cuspidate, obtuse or subcordate at base, mostly entire on mature trees, on younger ones often sharply dentate or sinuate-dentate, or both forms on the same branch, coriaceous, about 2 inches long and half as wide, rarely larger or in the mountain form often much smaller, at first fulvous-tomentose beneath, after a year or more glabrate and bluish or whitish; petioles about 3 lines long: aments sometimes branched, tomentose, soon glabrate: calyx-lobes 5 to 7, broadly ovate, acute, glabrous, ciliate: anthers about 10, conspicuously cuspidate: pistillate flowers sessile or rarely in spikes: cups covered with small triangular appressed scales more or less hidden in a dense yellow or fulvous tomentum, very variable in shape and size, ½ to an inch wide, hemispherical and rather thin to flat-saucershaped and very thick with a broad thick rim: nut oval, obtuse, ½ to 1½ inches long and half as thick, often somewhat pubescent within. — Engelm. l. c. 383. *Q. fulvescens,* Kellogg, Proc. Calif. Acad. i. 67, 71. *Q. crassipocula,* Torr. Pacif. R. Rep. v. 365, t. 9.

Var. (?) **vacciniifolia,** Engelm. l. c. 393. A shrub 2 to 6 feet high, with entire oval and obtuse or ovate-lanceolate and acute leaves, ¾ to 1½ inches long by 2 to 4 lines wide, on petioles 1½ to 3 lines long: acorns ¾ to 1 inch long. — *Q. vacciniifolia,* Kellogg, l. c. i. 96.

The Californian Live Oak, one of the most conspicuous and beautiful oaks of the Coast Ranges and Sierra Nevada throughout the length of the State, at the higher altitudes often a low shrub. It frequently attains a diameter of 3 to 5 feet, and a tree was found by Prof. Brewer in Emidio Cañon 28 feet in circumference and with 150 feet spread of branches. The fertile branchlets very often spend their force in the perfection of the fruit and do not grow beyond it, so that the fruit may have the appearance of maturing the first year though in fact biennial. The pubescence of the cups and of the lower side of the leaves is not scaly, but consists of a dense furze of articulated glandular hair. The abortive ovules are usually found scattered over the sides of the seed. The variety is certainly peculiar in its habit, and the leaves appear to be always entire, but no other difference is discoverable.

9. **Q. tomentella,** Engelm. l. c. 393. A middle-sized tree with tomentose branchlets: leaves oblong-lanceolate, 2 or 3 inches long, on petioles 3 or 4 lines long, obtuse at base, acute, crenate-dentate or rarely entire, coriaceous and strongly ribbed, with revolute margins, densely tomentose when young, becoming glabrate above: aments and oval calyx-lobes stellate-pubescent: anthers about 10, cuspidate: acorns subsessile; cup shallow, 10 or 11 lines wide, fulvous-tomentose; nut ovate, about 16 lines long.

Guadalupe Island, *Dr. E. Palmer.* Sometimes 40 feet high; closely allied to the last, but apparently well distinguished by the dentation and strong ribs of the leaves, and by the pubescence, which is only sparingly mixed with articulated hairs. The pubescence upon the branches persists for several years.

10. **Q. Palmeri,** Engelm. A tall shrub, with small coriaceous and very rigid leaves (6 to 10 lines long), on petioles a line or two long, round-oval, obtuse or subcordate at base, with undulate and strongly spinose-dentate margins: calyx-lobes 5 to 7, ovate, obtuse, glabrous, slightly ciliate: anthers 10, emarginate: acorns subsessile; cups turbinate, 6 to 9 lines wide, the minute scales covered by a dense fulvous furze; nut densely tomentose within; abortive ovules basal. — *Q. chrysolepis,* var. *Palmeri,* Engelm. l. c. 383.

In the mountains of San Diego County, near the Boundary; at Larken's Station and Las Juantas, *Dr. E. Palmer,* 1875. About 8 or 10 feet high: leaves resembling those of *Q. undulata,* but

thicker and more spiny. It is closely allied to *Q. chrysolepis*, but distinguished by the shape of the anthers and cup, by the basal ovules, and by the dense coating on the inside of the shell, which it has in common with the Black Oaks.

* * *Abortive ovules borne at the top of the seed: anthers usually larger and fewer* (4 *or* 5) *except in n.* 11: *stigmas on long spreading or recurved styles: nut silky-tomentose within. Bark dark or black: wood generally more porous and perishable: lobes and teeth of the leaves setaceously mucronate.* — Black Oaks.

\+ *Acorns maturing the first season: leaves subpersistent.*

11. **Q. agrifolia,** Née, l. c. 271. A stately tree of the largest dimensions, sometimes shrubby, with very thick gray or leather-colored smoothish bark (becoming cracked only in the oldest trees), and with brittle wood: young growth with a slight soon deciduous stellate pubescence: leaves oval to orbicular or oblong, about 2 or rarely 3 inches long, usually obtuse or cordate at base, sinuately spinose-dentate or rarely entire, on downy petioles 3 or 4 lines long, mostly convex above, pale-green without lustre and only slightly reticulate, pale and smooth beneath: aments at last glabrate: calyx-lobes 5 or 6, ovate, nearly glabrous: anthers about 6, sometimes 8 or 10, obtuse or cuspidate: acorns subsessile or sessile, solitary or sometimes clustered; cup turbinate, 3 to 5 lines wide and about as deep, with imbricated lanceolate brown slightly pubescent scales; nut elongated, tapering, 1 to 1½ inches long by 3 or 4 lines thick. — Nutt. Sylva, i. 5, t. 2. *Q. oxyadenia,* Torr. in Sitgr. Rep. 172, t. 17.

Var. **frutescens.** Shrubby, 3 to 5 feet high, with smaller leaves, often only an inch long: acorns ¾ to 1 inch in length, often crowded.

Common in the maritime portions of California, principally south of San Francisco Bay, rare as far north as Mendocino County. A most picturesque oak, with a stout low trunk often 8 to 12 feet, sometimes 16 to 21 feet, in circumference (base of Mount Diablo, *Brewer*), and with a spread of branches of 120 feet. It is the "Encino" of the Mexicans. The shrubby variety grows with it, especially southward, but also on the Oakland Hills and near Mendocino, *Bolander*. This tree behaves curiously in many respects. Though properly an evergreen, it loses its leaves gradually during the winter and in some specimens entirely before the spring shoots appear, while others in the same neighborhood retain them several weeks or sometimes months longer. Dr. Bolander has observed that the trees that flower abundantly lose the old leaves earlier, while the really evergreen trees are apt not to flower at all. The aments often spring from the axils of young leaves. Sometimes, especially where the first growth has been injured by locusts, fresh sprouts bearing flowers are formed later in the summer, and their young fruit is apt to persist through winter and even to enlarge somewhat in the following spring, but it never matures. Such aftergrowth may easily be mistaken for a biennial maturation (*E. Hilgard*).

\+ \+ *Acorns maturing in the second season.*

++ *Leaves persistent.*

12. **Q. Wislizeni,** A. DC. One of our largest oaks, but sometimes a low shrub: bark black and rough: leaves coriaceous, smooth, strongly reticulated on the upper surface, dark green and shining, 1 to 3 or rarely 4 inches long by ½ to 2 inches wide varying exceedingly in shape, from narrowly lanceolate to broadly oval, mostly oblong-lanceolate, truncate or subcordate or the narrower ones often acute at base, entire or serrulate or serrate, or often sinuate-dentate or -lobed and even with the lobes dentate; petioles 2 to 4 lines long, at first pubescent: aments pubescent, like the young leaves, with soon deciduous stellate hairs: calyx-lobes 5, broadly oval, glabrous, ciliate: anthers 3 to 6 (usually 4 or 5), slightly apiculate: styles very slender, recurved, often more than 3: acorns sessile or pedunculed or even spicate; cup turbinate, very deep or even tubular (½ to 1 inch deep), covered with brown lanceolate subpubescent imbricate scales; nut slender, tapering, ¾ to 1½ inches long. — Prodr. xvi². 67, where the species is erroneously assigned to Northern Mexico; Engelm. l. c. 396. *Q. Morehus,* Kellogg, Proc. Calif. Acad. ii. 36?

Var. **frutescens.** A shrub 3 to 10 feet high, with smaller oval entire or spinose-dentate leaves, 1 to 1½ inches long.

Common in the valleys and on the lower mountains throughout the State and ascending into the Sierra Nevada; the variety is the "Desert Oak" of the southeastern desert region, ranging northward to Shasta. A magnificent tree, with very dense dark green and shining foliage, sometimes 10 to 12 or even 18 feet in circumference (Shasta, *Brewer*) and 50 or 60 feet high; bark paler and smoothish when young, very rough and black in old trees: wood said to be tough and durable. The leaves persist 14 or 15 months, longer than in the last, but rarely until maturity of the fruit. Winter-buds oval, a line or two long, brown and shining and slightly ciliate. Cups very variable in size, often deeper than in any other N. American oak. This species has been confounded with *Q. agrifolia*, but is readily distinguished by its biennial fruit, the strongly reticulated shining leaves, etc. Some forms closely approach the next species, which, however, has broader more deeply lobed and deciduous leaves and obtuse acorns.

++ ++ *Leaves deciduous.*

13. **Q. Kelloggii,** Newberry. A middle-sized tree, with rough black bark; branchlets soon glabrate: leaves thick, broadly oval, pinnatifid-lobed (like those of *Q. coccinea*), 3 to 4½ or rarely 6 inches long, the lobes tapering and entire or broad and lobe-dentate, at first tomentose or nearly glabrous, at length glabrate; petioles slender, 8 to 15 lines long: aments stellate-pubescent or smoothish: calyx with 5 broad ciliate lobes, bearing 4 or 5 anthers: acorns mostly on peduncles ½ to an inch long, often several together; cups hemispherical, often very deep (6 to 8 lines wide by 8 to 12 lines deep), with ovate-lanceolate obtusish imbricate scales; nuts oblong, obtuse, 12 to 16 lines long, by 10 to 12 wide. — Pacif. R. Rep. vi. 28, f. 6. *Q. rubra*, Benth. Pl. Hartw. 337. *Q. tinctoria*, var. *Californica*, Torr. Pacif. R. Rep. iv. 138. *Q. Sonomensis*, Benth.; A. DC. Prodr. xvi². 62.

Common in the Coast Ranges throughout the State, and also higher up on the western side of the Sierra Nevada, where it often is reduced to a shrub. The representative of the eastern Black Oaks, and distinguished from them chiefly by the form of the cup and nut. The species is now generally known as *Q. Sonomensis*, but Dr. Newberry's name, honoring the indefatigable botanical pioneer of California, has a priority of seven years.

§ 2. *Aments erect, pistillate at base and staminate above or entirely staminate: slender filaments many times longer than the very small anthers: pollen only half as large: stigmas linear: fruit biennial: leaves persistent.* — ANDROGYNE, A. DC.

14. **Q. densiflora,** Hook. & Arn. A middle-sized tree or shrub, with mostly smoothish bark and tomentose branchlets: leaves oblong, acute, obtuse or rarely acute at base, entire with revolute margins or sometimes dentate, tomentose especially beneath, at last glabrate and whitish, 2 to 4 or 5 inches long by ½ to 2 inches wide; petioles 3 to 6 lines long: aments 4 to 6 inches long, tomentose; flowers in glomerules of 3, supported by 3 bracts; calyx of 5 broad woolly lobes: anthers 10: acorns solitary or in short-peduncled clusters; cups very shallow, ¾ to 1¼ inches wide, covered with long-linear rigid rough spreading or recurved scales, silky-tomentose inside; nut oval or oblong, acute or obtuse, 1 to 1½ inches long, with a very thick shell, densely tomentose within. — Bot. Beechey, 391; Hook. Icon. t. 380; Nutt. Sylva, i. 11, t. 5. *Q. echinacea*, Torr. Pacif. R. Rep. iv. 137, t. 19.

From the Santa Lucia Mountains (*Palmer*) through the Coast Ranges and especially the Redwoods to the Shasta region. A pretty large tree, 50 to 60 or rarely 80 feet high (Santa Cruz Mountains, *Brewer*), and a foot or two in diameter; often a mere shrub, 5 to 7 feet high: bark light gray, rough only in the oldest trees. Acorns bitter. Leaves in some forms smaller, thicker, strongly ribbed and more frequently serrate; in others larger, thinner, and without conspicuous ribs. Intermediate between Oak and Chestnut, and approaching some E. Asiatic forms.

2. CASTANOPSIS, Spach. WESTERN CHINQUAPIN.

Staminate flowers in slender axillary and panicled aments upon the young shoots, with regularly 5 – 6-lobed perianth and usually twice as many stamens. Pistillate

flowers 1 to 3 in a scaly involucre sessile at the base of the aments; lobes of the perianth 6, in 2 rows. Styles usually 3. Ovary 3-celled, with 2 amphitropous ovules at the lower angle of each cell. Nuts 1 to 3, enclosed in the subglobose involucre, which is densely covered with stout branched prickles, at length irregularly dehiscent. Seed solitary. Cotyledons thick, plano-convex, edible. — Trees or sometimes shrubs, mostly with entire coriaceous leaves; fruit maturing in the second year.

A peculiar genus of Eastern Asia and the adjacent islands, of a dozen or more species, represented in California only by the following. It is intermediate between *Quercus* and *Castanea*, the former differing in its cupular 1-flowered involucre, imperfectly 3-celled ovary, and unisexual aments; the latter in the usually 6-celled ovary, pendent anatropous ovules, and the cotyledons convolute-plicate. The shell of the nut is much firmer and harder than in the other genera.

1. **C. chrysophylla,** A. DC. Leaves coriaceous, evergreen, lanceolate or oblong, 1 to 4 inches long, acuminate or only acutish, cuneate at base and shortly petioled, entire, green and glabrous above or sometimes scurfy, densely scurfy beneath with more or less yellow scales: male aments 1 to 3 inches long, densely pubescent: styles 3, stout, glabrous, divergent: fruiting involucre with stout divergent spines, ½ to 1 inch long, subverticillately many-branched: nut usually solitary, obtusely triangular, 6 lines long. — Seem. Journ. Bot. i. 182, & Prodr. xvi². 109; Watson, Bot. King Exp. 322. *Castanea chrysophylla*, Dougl.; Hook. in Lond. Journ. Bot. ii. 496, t. 16, and Bot. Mag. t. 4953; Newberry, Pac. R. Rep. vi. 26, fig. 4. *Castanea sempervirens*, Kellogg, Proc. Calif. Acad. i. 71.

From Oregon to Monterey, and in the Sierra Nevada to an altitude of 6,000 feet. Often only a shrub of 2 to 6 feet in height (var. *minor*, Benth. Pl. Hartw. 337), fruiting freely, but in Mendocino County and northward becoming a large tree 50 to 125 feet high and 2 or 3 feet in diameter.

Order XCVI. CORYLACEÆ.

Distinguished from the *Cupuliferæ* by the male flowers consisting of a staminiferous scale-like bract without perianth, and by the foliaceous or tubular laciniate involucre of the fruit; stamens several, with short often divided filaments and distinct anther-cells, usually hairy at the apex; pistillate flowers in a short spike, 2 to each bract, with small bractlets which become much enlarged and involucrate in fruit; ovary imperfectly 2-celled, with 2 pendulous anatropous ovules; seed solitary, with simple integument. Leaves doubly toothed, plicate in æstivation. Involucre acid to the taste.

Small trees or shrubs of the northern hemisphere, the order comprising the Hornbeam and Ironwood (*Ostrya* and *Carpinus*) of the Atlantic States and Old World (a half-dozen species), a small genus peculiar to Japan (*Distegocarpus*), and the following one. The wood is usually very hard and heavy.

1. CORYLUS, Tourn. Hazelnut. Filbert.

Aments drooping, axillary from scaly buds, densely pubescent. Stamens 4 (or 8 with one-celled anthers by division of the filaments), 2-bracteolate, on a cuneate-obovate bract. Pistillate spikes terminal on leafy shoots. Ovary tipped with the irregularly lobed limb of the adherent perianth; style short, with 2 linear elongated stigmas. Bractlets 2, becoming a leafy or somewhat coriaceous often tubular involucre, with lacerately lobed margin, enclosing an ovoid bony 1-celled 1-seeded

nut. Cotyledons thick and edible, plano-convex, the base including the short radicle.

Five other species are found in Europe and Asia, and one in the Atlantic States.

1. **C. rostrata,** Ait. Leaves broadly ovate or oval, 1 to 4 inches long, acuminate or acute, cordate or rounded at base, somewhat pubescent beneath on the nerves; petioles slender, nearly smooth: fruiting involucre densely hispid, of united bracts more or less prolonged and narrowed into a tube above the nut, 1 to 1½ inches long, often recurved: nut 5 or 6 lines in diameter. — Var. **Californica,** A. DC. Pubescence more abundant, villous and often glandular: leaves an inch or two long, less acuminate and on rather shorter petioles: tube of the involucre shorter, often scarcely exceeding the nut. — Prodr. xvi². 133.

A shrub 3 to 6 feet high, ranging from Middle California to Oregon. The typical form of the Atlantic States occurs in Washington Territory and the Rocky Mountains, and is nearly repeated in Northern Asia.

Order XCVII. ARISTOLOCHIACEÆ.

Perennial herbs or shrubs, with alternate entire mostly cordate or reniform pedately nerved petioled leaves, no stipules, and perfect flowers, the lurid or greenish perianth with a valvate regularly or irregularly 3-lobed limb, the tube more or less adnate to a 6-celled ovary, which becomes a many-seeded berry or 6-valved capsule; stamens 6 to 12, on the ovary and more or less adnate to the style, with extrorse anthers; styles usually 6, united at base; seeds anatropous, in 1 or 2 rows on the central angle of each cell, with fleshy rhaphe, and minute embryo in copious albumen.

An order of 5 genera and nearly 200 species, chiefly of the warmer regions of the globe and especially of tropical America. Most of them possess bitter-tonic or stimulant and often aromatic properties, and some have long been known for their value in medicine.

1. **Asarum.** Perianth short, 3-cleft. Stamens 12. Capsule globose. Acaulescent herbs, with apparently terminal flowers.
2. **Aristolochia.** Perianth tubular, contracted at the throat. Stamens 6. Capsule oblong. Twining shrubs, with supra-axillary flowers.

1. ASARUM, Tourn. Wild Ginger.

Perianth regular, campanulate, with the limb spreading or recurved, persistent, 3-cleft, the tube adherent to the ovary; tips of the segments infolded in the bud. Stamens 12, nearly free from the styles, at first reflexed, the alternate ones shorter; connective continued beyond the anthers, pointed. Ovary more or less inferior: styles 6, more or less united. Capsule globose, fleshy, usually bursting irregularly. Seeds large, thick, in two rows in each cell. — Nearly acaulescent herbs with creeping aromatic rootstocks, the branches bearing 2 or 3 membranous sessile caducous bracts at base and 2 closely approximate long-petioled reniform-cordate leaves, with a pedunculate flower in the axil of the lower leaf.

Besides the following species, three are found in the Atlantic States, one in Europe, one in the Himalayas, and three or four in Japan. The Californian species have the ovary wholly inferior.

1. **A. Hartwegi,** Watson. Rather stout, tufted, floccose-pubescent especially below: leaves usually large (2 to 6 inches long), thick, cordate with large rounded auricles, usually acute, quite glabrous above and mottled, the margin ciliate: peduncle stout, a half to an inch long: ovary 6 lines broad: lobes of the calyx ovate, narrowed to a linear apex, 1 to 1½ inches long: filaments rather stout, nearly free from

the style; anthers about a line long, the produced connective setaceous, a line or two long: styles short, nearly distinct, scarcely equalling the anthers: seeds ovate, 2 lines long. — Proc. Amer. Acad. x. 346. *A. Hookeri*, var. *majus*, Duchartre, DC. Prodr. xv¹. 424.

Frequent in the Sierra Nevada, at an altitude of 4,000 to 7,000 feet; "growing in thick tufts, the leaves strikingly mottled," *Gray.*

2. **A. caudatum**, Lindl. More slender, with elongated rootstocks, rather sparingly pubescent with loose floccose hairs: leaves cordate-reniform, somewhat cucullate, shortly acute or acutish (the smaller sometimes obtuse), sparingly pubescent above at least on the veins, 2 to 4 inches long: peduncles slender, 6 to 15 lines long: ovary about 4 lines broad: calyx-lobes oblong, more or less long-attenuate (1 to 2½ inches long): filaments stout; the free apex of the connective much shorter than the anther: styles united, equalling the stamens: seeds ovate, 1½ lines long. — Bot. Reg. xvii, under t. 1399; Watson, l. c. *A. Hookeri*, Fielding, Sert. Plant. t. 32.

In the Coast Ranges from Santa Cruz to Oregon and British Columbia, in damp woods and cañons.

3. **A. Lemmoni**, Watson. Closely resembling the last, but leaves flat, all rounded at the summit, and nearly glabrous above; calyx-lobes short (4 to 6 lines long), obtuse or acute: seeds narrower. — Proc. Amer. Acad. xiv. 294.

In the Sierra Nevada; Plumas County, *J. G. Lemmon*, *Mrs. R. M. Austin.*

2. ARISTOLOCHIA, Tourn. Pipe-Vine.

Perianth tubular, irregular, inflated above the elongated ovary and deciduous, the limb variously lobed or cleft. Anthers 6, sessile and adnate to the short simple style. Stigma 3–6-lobed or angled. Capsule 6-angled and 6-valved, septicidally dehiscent. Seeds horizontal, in one row in each cell, numerous, flattened. — Mostly twining shrubs, with axillary flowers.

A widely distributed genus of 170 species; of which six are found in the Atlantic States.

1. **A. Californica**, Torr. Woody, climbing to a height of 6 to 10 feet, more or less densely pubescent with short silky hairs: leaves ovate-cordate, obtuse or acutish, 2 to 4 inches long, on short petioles: peduncles slender, an inch or two long, with a small cordate or obovate foliaceous bract in the middle: calyx-tube broadly saccate and closely doubled upon itself, 15 to 18 lines long from the base to the top of the curvature, half an inch broad, not much contracted at the throat, slightly pubescent; limb 2-lipped, the upper lip of 2 broad obtuse lobes with a disk-like thickening on the inner side: anthers contiguous in pairs under each of the 3 broad obtuse lobes of the stigma: ovary linear-clavate, pubescent: capsule spongy-coriaceous, obovate, attenuate to a slender base, 6-winged, 1½ inches long: seeds cuneate-ovate, deeply concave on the upper side, with a very prominent spongy rhaphe. — Pacif. R. Rep. iv. 128.

Near the coast from Monterey to Marin County, rather rare; also in the Upper Sacramento Valley, near Fort Reading (*Bigelow*), and at Chico, *Mrs. J. Bidwell.* Flowers described as dull-purple at base and summit, paler in the middle. March and April.

Order XCVIII. RAFFLESIACEÆ.

Leafless parasites on the roots or branches of dicotyledonous plants, with regular mostly dœcious flowers, numerous sessile anthers, and 1-celled more or less inferior ovary with several many-ovuled distinct or confluent placentæ; fruit baccate; seeds numerous, minute, with bony testa, and embryo without cotyledons.

A small order of half a dozen rather heterogeneous genera and 20 widely scattered species, the only one that approaches our limits being the following, which may be found in the southeastern portion of the State.

1. PILOSTYLES, Guillem.

Flowers diœcious, minute, purplish, subsessile on the branches of chiefly leguminous trees or shrubs; bracts and segments of the perianth scarcely distinct, imbricate in several rows, persistent. Anthers numerous, in 1 or 3 rows below the dilated top of the staminal column, 1-celled, transversely dehiscent. Summit of the ovary depressed and truncate, surrounded by a stigmatic ring. Fruit a fleshy berry, with numerous minute rounded seeds covering the inner walls of the cavity. — Solms-Laubach, Fl. Bras. fasc. lxxvii. 123.

Four other species of this genus occur in tropical America, from Mexico to Brazil and Chili, with one in Africa and one in Persia.

1. **P. Thurberi**, Gray. Flowers scattered, sessile, 1½ lines in diameter: bracts and sepals similar, rounded, glabrous, adnate to the lower half of the globose-ovoid ovary: stigma disk-shaped, with a thickened margin and slightly prominent centre: seeds orthotropous, oval, acutish at both ends, on a slender funiculus of their own length. — Pl. Thurb. 326; Torrey, Bot. Mex. Bound. 207, t. 52; Hook. f. in DC. Prodr. xvii. 115.

On a small mountain near the Gila River in W. Arizona (*Thurber*), on branches of *Dalea Emoryi*. The staminate flowers are unknown.

Order XCIX. SANTALACEÆ.

Herbs or shrubs, usually root-parasitic, with angled or striate branches, entire and mostly alternate sessile leaves without stipules, and mostly perfect flowers with 3 – 5-cleft valvate perianth adherent to the 1-celled 2 – 4-ovuled ovary, which becomes an indehiscent 1-seeded usually nut-like fruit; stamens 3 to 5, opposite to the perianth-lobes, at the edge of an epigynous often lobed disk; style 2 – 5-lobed; ovules suspended from the top of a free central placenta; seed without testa, the small straight embryo axile at the apex of the abundant albumen; radicle superior.

An order of 20 genera and about 200 species, distributed through the temperate and tropical regions chiefly of the Old World. Besides the following, three other small genera are represented in the Atlantic States.

1. COMANDRA, Nutt. Bastard Toad-flax.

Flowers perfect, the campanulate or urn-shaped perianth with a 5- (rarely 4-) lobed persistent limb. Disk with a free lobed margin. Stamens included, with linear filaments; anthers attached by tufts of hairs to the base of the calyx-lobes, the cells distinct at base. Style filiform. Placenta contorted, filiform, about 3-ovuled. Fruit nut-like or drupe-like, the cavity filled by the globular seed. — Low herbaceous smooth perennials, with subterranean rootstocks; leaves alternate, nearly sessile, glaucous, the lowest scale-like; flowers greenish-white, in small terminal or axillary umbellate clusters. A third species is found in British America and one other in S. Europe.

1. **C. umbellata**, Nutt. Stems leafy, 6 to 15 inches high: leaves oblong, obtuse or acute, ½ to 1½ inches long: umbels few-flowered, corymbosely clustered at

the summits of the stems : flowers 1½ to 2 lines long, on slender pedicels, the white oblong erect or slightly spreading lobes about equalling the green tube, which is continued conspicuously above the ovary : style slender : fruit dry, globular, 2 or 3 lines in diameter ; fruiting pedicels 2 to 3 lines long.

In the foothills of the Sierra Nevada from Mariposa County northward to Washington Territory and thence across the continent to the Saskatchewan and the northern Atlantic States.

2. **C. pallida**, A. DC. Differing from the last in its narrower more glaucous and acuter leaves, which are linear to narrowly lanceolate (or those upon the main stem oblong), all acute or somewhat cuspidate ; fruit larger, ovoid, 3 to 4 lines long, sessile or on short stout pedicels. — Prodr. xiv. 636 ; Watson, Bot. King Exp. 319.

From Oregon to Colorado and New Mexico, frequent in the mountains of Nevada (*Watson*) and collected by *Newberry* in Northwestern Arizona ; probably to be found in California eastward of the Sierra Nevada.

Order C. LORANTHACEÆ. (By Dr. George Engelmann.)

Evergreens, parasitic on shrubs or trees, dull yellowish-green or brownish, with dichotomous branches and swollen joints, the opposite thick and coriaceous exstipulate and entire leaves foliaceous or reduced to mostly connate scales : flowers diœcious (in our genera), of 2 to 5 sepals coherent at base and valvate in æstivation ; anthers as many as the sepals and inserted upon them, 1 – 2-celled and sessile (in our species) ; ovary inferior, 1-celled, with a solitary erect orthotropous ovule, the style short or none ; fruit a berry with glutinous endocarp ; seed with copious fleshy albumen, enclosing a straight axile embryo with superior radicle. — Flowers in our species small and inconspicuous, greenish.

A considerable order, of about 15 genera and 300 species, distributed mostly through the tropical regions both of the Old and New World, with a few species in the temperate zones of both hemispheres. Only two genera are represented in the United States. The fruit contains a peculiar viscid and tenacious elastic substance known as Bird-lime.

1. **Phoradendron.** Flowers globose, mostly 3-lobed. Anthers 2-celled, opening by 2 pores or slits : pollen-grains smooth. Berry globose, pulpy and semitransparent. Cotyledons foliaceous. Leaves foliaceous or scale-like.

2. **Arceuthobium.** Flowers mostly compressed ; the staminate usually 3-parted, the pistillate 2-toothed. Anthers a single orbicular cell, opening by a circular slit ; pollen spinulose. Berry compressed, fleshy. Cotyledons very short. Leaves scale-like, connate.

1. PHORADENDRON, Nutt. Mistletoe.

Flowers globose, immersed in the rhachis of jointed spikes. Calyx 3- (rarely 2- or 4-) lobed. Anthers sessile on the base of the lobes, 2-celled, the cells opening by a pore or slit : pollen-grains smooth. Stigma sessile, obtuse, entire or more or less 2-lobed. Berry globose, pulpy, semitransparent, crowned with the persistent sepals. Embryo with foliaceous cotyledons. — Parasitic on the branches of various kinds of trees : spikes single or in pairs in the axils of opposite leaves, or rarely terminal, the lowest joint sterile, the others (1 to many) bearing solitary or several flowers on each side ; the staminate spikes usually with more numerous and more floriferous joints than the pistillate. Flowering in February or March and maturing its fruit the next winter. — Nutt. Pl. Gambel, 185.

An American genus, of about 80 species, ranging from the southern Atlantic States and Oregon to Brazil and Peru, mostly tropical. Only the following species are found within the limits of the United States.

* *Leaves foliaceous, mostly dilated upward from a narrow base.*

1. **P. flavescens,** Nutt. Branches terete, pubescent when young (as also the spikes), often a foot long or more: leaves oblanceolate to obovate or orbicular, ½ to 2 inches long, obtuse, 3-nerved, at last glabrous: bracts connate into a short truncate cup: flowers depressed-globose, the calyx-lobes ciliate on the margin: staminate spikes opposite or verticillate, usually shorter than the leaves, 3–7-jointed, the numerous flowers mostly in 4 to 6 rows on each side and occupying nearly the whole joint, very fragrant with the odor of pond-lilies; anthers transverse, opening by 2 pores: pistillate spikes usually opposite, shorter (rarely 5–6-jointed), the flowers (2 to 7 on each side of a joint) in not more than three series: berries white, 2 lines in diameter. — Engelm. Pl. Lindh. 212. *Viscum flavescens,* Pursh, the common glabrate spatulate-leaved southeastern form.

Var. **macrophyllum,** Engelm. Leaves large (2 to 2½ inches long), broad, often 5-nerved, glabrate: flowers larger, in stout short-jointed spikes. — Wheeler's Rep. vi. 252.

Var. **villosum,** Engelm. l. c. Leaves small or middle-sized, orbicular to spatulate, permanently pubescent or tomentose: spikes slender, rather short. — *P. villosum,* Nutt. l. c.; Engelm. Pl. Lindh. 212.

The latter variety is common throughout the State, chiefly on oaks, from S. California to Oregon, and eastward to New Mexico and Texas; the former occurs on *Populus, Platanus, Fraxinus* and other trees, from S. California to New Mexico. Var. TOMENTOSUM (*Viscum tomentosum,* DC.) is found in Northern Mexico, on *Mimoseæ,* and is densely tomentose, with slender elongated spikes.

2. **P. Bolleanum,** Eichler. Puberulent, at length glabrous: branches terete, less than a span long: leaves thick, spatulate to linear, 6 to 12 lines long by 1 to 3 wide, nerveless, obtusish: spikes opposite or rarely in fours, with connate minutely ciliate bracts; the staminate of two 6–12-flowered joints, the fertile of a single 2-flowered joint: anthers transverse, opening by pores: fruit white, 1½ lines in diameter. — Fl. Bras. v². 134ᵐ. *Viscum Bolleanum,* Seem. Bot. Herald, 295, t. 63. *P. pauciflorum,* Torrey, Pacif. R. Rep. iv. 134.

On conifers, mostly *Juniperus,* from the Geysers (*Brewer*) to San Felipe (*Palmer*) and into Arizona and Mexico; also on Guadalupe Island, *Palmer.* A specimen on *Abies concolor,* from Duffield's Ranch near Auburn (*Bigelow*), is larger and with larger broader leaves.

* * *Leaves reduced to short mostly connate scales: spikes opposite, mostly few-flowered.*

3. **P. Californicum,** Nutt. Pubescent or at last glabrous: branches terete, slender, a foot or two long: scales broadly ovate, acute, spreading: staminate spikes of 2 or 3 (rarely 5) flower-bearing joints, each with 2 to 6 ovate-subglobose flowers: anther-cells oblong, opening by a longitudinal slit: fertile spikes sometimes with nearly as many joints and flowers, the joints elongated (often an inch long) in fruit: berries reddish, 2 lines wide. — Pl. Gambel, 185; Engelm. Pl. Lindh. 213.

Southern California and Arizona, on various *Mimoseæ* and *Cassieæ, Larrea,* etc.

4. **P. juniperinum,** Engelm. Glabrous, stout, densely branched, 6 to 9 inches high: branches terete, the ultimate branchlets quadrangular: scales broadly triangular, obtusish, connate or distinct, ciliate: staminate spikes of a single 6–8-flowered joint (rarely two): anthers transverse, opening by pores: pistillate spikes 2-flowered: berry globose, whitish or light red, 1½ lines wide. — Pl. Fendl. 58.

Var. **Libocedri,** Engelm. Branches a foot long or more, slender: joints more elongated, the ultimate ones more sharply quadrangular.

On different species of *Juniperus,* from Truckee Pass southward and through S. Nevada and Arizona to New Mexico; the variety on *Libocedrus decurrens,* from the Yuba River to San Bernardino.

2. ARCEUTHOBIUM, Bieb.

Flowers axillary and terminal, solitary or several from the same axil. Staminate flowers 2–5- (mostly 3-) parted, compressed or the terminal ones globose before opening. Anthers adnate to the lobes, circular and 1-celled, dehiscing by a circular slit at base; pollen-grains spinulose. Pistillate flowers ovate, compressed, 2-toothed, subsessile and partly enclosed; the pedicel at length elongated, exsert and recurved. Berry fleshy, compressed, dehiscent at the circumscissile base. Cotyledons very short, only indicated by a notch. — Parasitic on conifers, glabrous, with rectangular branches and connate scale-like leaves: flowers often crowded into apparent spikes or panicles, opening (in our species) in summer or autumn and maturing their fruit in the second autumn, when the berries suddenly and forcibly eject the glutinous seeds to the distance of several yards.

A small genus, represented in S. Europe by a single species, and in America ranging from the northern border of the United States to Mexico, chiefly in the mountains.

* *Staminate flowers all (or nearly all) terminal on distinct peduncle-like joints, paniculate.*

1. **A. Americanum,** Nutt. Slender, dichotomously or verticillately much-branched, greenish yellow; staminate plants sometimes 3 or 4 inches long ($\frac{1}{4}$ to a line thick at base), fertile plants much smaller: flowers small, the staminate a line broad or more, with ovate-orbicular acutish lobes, the pistillate a half to one line long: fruit 2 lines long. — Engelm. Pl. Lindh. 214, and Wheeler's Rep. vi. 252.

Only on *Pinus contorta* (and apparently *P. Banksiana* in the Saskatchewan region), from Wyoming to Oregon and southward to Colorado and California (Little Yosemite Valley, *Bolander*). Flowering mostly late in autumn apparently, but found by *Parry* in Wyoming in flower in July; fruit mature in August and September. Its shoots creep along within the tissue of the bark on young branches of the pine, and in the autumn bud out in the form of little knobs among the bud-scales at the end of three-years-old limbs, developing into flowering plants the next season. When once established it may continue to sprout from the same base for many (30 or more) years, causing hypertrophy of the wood and bark of the limb and often its final destruction. Fruiting and flowering branchlets are often seen in juxtaposition in the same whorl, but without leaf-bearing branchlets, and never in superposition.

The type of the genus, *A. Oxycedri*, Bieb., of the Old World, is allied to this, but distinguished from it and from all American species by its staminate flowers being all terminal on short branchlets and usually in threes, scarcely a line wide and with orbicular lobes, and by the much smaller oblong fruit, less than $1\frac{1}{2}$ lines long. The northeastern *A. pusillum*, Peck, of the Adirondacs, growing on *Picea nigra*, also belongs to this section.

* * *Staminate flowers axillary (with a terminal one), forming simple or compound spikes.*

+– *Slender, greenish-yellow: accessory branchlets of fruiting specimens flower-bearing.*

2. **A. Douglasii,** Engelm. Similar to the last, but smaller, $\frac{1}{4}$ to 1 inch high: branches suberect, solitary, or with accessory ones behind (never beside) the primary ones: flowers in short (usually 5-flowered) spikes; the staminate less than a line wide with orbicular-ovate acutish lobes: fruit $2\frac{1}{2}$ lines long. — Wheeler's Rep. vi. 253.

Var. **abietinum,** Engelm. A larger form, 1 to 3 inches high (the fertile smaller) with spreading or even recurved few-flowered branchlets: staminate flowers $1\frac{1}{4}$ lines wide: fruit scarcely 2 lines long.

On *Pseudotsuga Douglasii*, from New Mexico to S. Utah and N. Arizona; the variety on *Abies concolor* in Sierra Valley (*J. G. Lemmon*) and S. Utah, *Parry*. Flowering apparently in October. Distinguished from the last by its usually smaller size, the superimposed (never verticillate) accessory branchlets, lateral flowers, and larger fruit. Its creeping stroma buds out all along the

branch, and not between the bud-scales only as in the last. Another variety, with very small fruit, is found on *Picea Engelmanni* in Northern Arizona.

+– +– *Stouter, greenish-brown: accessory branchlets of fruiting specimens mostly leaf-bearing.*

3. **A. divaricatum,** Engelm. Stouter than the last, 2 to 4 inches high and a line in diameter at base, olive green or pale brownish; branches spreading, often flexuous or recurved: staminate flowers few and scattered or in 3–7-flowered spikes, a line wide, with ovate acute lobes: fruit 1½ to 1¾ lines long. — Pl. Wheeler, 1874, 16, and Wheeler's Rep. vi. 253. *A. campylopodum,* var., Engelm. Pl. Lindh. 114.

On *Pinus edulis* and *P. monophylla,* from New Mexico and S. Colorado to Arizona and S. Utah, and to be looked for on the latter species in S. California. Flowering in August and September. Intermediate in size and color between *A. Douglasii* and the following species, but well characterized by its slender habit, spreading growth, and small and rather scanty male flowers.

4. **A. occidentale,** Engelm. Stout, 2 to 5 inches high, 2 to 2½ lines thick at base, paniculately much-branched: staminate plants brownish yellow, smaller, the pistillate commonly of a darker olive-brown color: staminate flowers in long dense spikes, often 9 to 17 on a single axis, their buds ventricose with the upper edge curved outward; calyx 3–5- (usually 4-) parted, 1½ to 2 lines wide; anthers sessile below the middle of the lanceolate acuminate lobes: fruit 2½ lines long.

Var. **abietinum,** Engelm. More spreading and less densely branched, the accessory branches in the fruiting plant bearing fertile flowers as often as they do leaf-buds. — *A. abietinum,* Engelm. Proc. Amer. Acad. viii. 401.

On various conifers of the Coast Ranges and Sierra Nevada (*Pinus insignis, P. Sabiniana,* and *P. ponderosa*), from Salinas Valley and Walker's Basin to Oregon. It is the only American species found also on *Juniperus* (Silver Mountain, *Brewer*). The variety occurs on *Abies grandis* in the valley of the Columbia, *Hall.* Flowering in August and September.

The closely allied A. VAGINATUM, Eichler (*Viscum vaginatum,* HBK.), upon the pines of the Mexican mountains, of which only incomplete material has been collected, has shorter spikes and smaller mostly 3-parted staminate flowers with broader and shorter lobes. A. ROBUSTUM, Engelm., on *Pinus ponderosa* in the Rocky Mountains and Arizona, has shorter spikes than *A. occidentale,* with shorter flat appressed staminate buds, the 3-parted flowers (opening in June) with shorter and broader lobes, bearing the anthers above their middle. Of the only remaining known species of this curious genus Seemann gathered on the Sierra Madre of Mexico a staminate specimen, in bud only, which is distinguished from all others by its greater thickness and by the long spikes of large verticillate 4-parted flowers, mostly 6 in a whorl. It may therefore bear the name A. VERTICILLIFLORUM.

Subclass II. GYMNOSPERMÆ.

Ovules (always orthotropous) naked upon the surface of a scale or bract or within a more or less open perianth, fertilized by the direct contact of the pollen with the nucleus. Flowers monœcious or diœcious. Cotyledons 2, or often several in a whorl. Wood composed mainly of disk-bearing tissue without proper vessels.

Order CI. GNETACEÆ.

Shrubs or small trees of very various habit, mostly with jointed opposite or fascicled branches and foliaceous or scale-like opposite (or ternate) exstipulate leaves, the flowers mostly diœcious, with decussate persistent bracts; the staminate in aments, with solitary or monadelphous stamens within a membranous bifid calyx-like perianth, the anther-cells (1 or 2) dehiscent by a pore or chink at the apex: fertile flowers of an erect sessile ovule, with simple integument (separating above into two) terminated by an exserted style-like process (*micropyle*), included within an urceolate perianth which becomes hardened and often thickened in fruit. Embryo axile in fleshy albumen, with superior radicle and two short cotyledons.

An order intermediate between the coniferous and the angiospermous orders, being allied on the one side to the *Taxaceæ* and on the other to the *Loranthaceæ*, etc. It contains only two genera besides *Ephedra;* viz., *Gnetum*, of a dozen or more species native to tropical Asia and America, with broad petiolate leaves, verticillate flowers, and often drupaceous fruit with double integument, and *Welwitschia*, a remarkable S. African genus of a single species, having a thick depressed platform-like stem and only a single pair of very large permanent leaves.

1. EPHEDRA, Tourn.

Inflorescence diœcious, axillary; aments small, of decussately imbricated opposite or ternate and more or less connate bracts. Staminate flowers solitary at the base of each bract, with compressed 2-lobed membranous perianth, and the 3 to 8 filaments united into a clavate staminal column. Anthers 2-celled, rounded or subcuneate. Fruiting aments with all the lower bracts empty, the flowers (1 to 3) sessile at the apex. Perianth coriaceous, hardening in fruit, 3 – 4-angled, perforated only for the passage of the micropyle. Ovule solitary; micropyle slender, entire. Seed with thin testa. — Shrubs with numerous equisetum-like branches, the leaves reduced to sheathing (at length distinct) scales, persistent or deciduous.

A genus of about 20 species, in the warmer temperate regions or mountains of the tropics, chiefly in desert or alkaline localities. Half of the species belong to the Old World; the rest, with the exception of the following, are South American. Our species have the aments solitary or few in the axils, and the scales, branches and bracts sometimes ternate — the last character being exceptional in the genus and order. Of little value except for their well known medicinal virtues, respecting which see Rothrock in Wheeler's Rep. vi. 50.

* *Scales 2-lobed and branches (not spinose) opposite: bracts opposite and evidently connate, scarious only on the margin: fruit smooth, solitary or in pairs.*

1. **E. Nevadensis,** Watson. An erect shrub, 2 feet high or more, with erect or spreading usually somewhat scabrous branches: scales (1 to 3 lines long) sheathing, with short blunt lobes or with more or less elongated tips, at length mostly deciduous: staminate aments sessile or rarely shortly pedunculate, ovate, of 4 to 6 pairs of bracts; the 4 to 8 anthers usually closely sessile upon the exserted staminal

column: fertile aments pedunculate; the peduncle ½ to 3 lines long or more, with reduced bracts or rarely naked; bracts of the ament 4 or 5 pairs, round-ovate: fruit 3 or 4 lines long, exserted, acutish: micropyle a line long. — Proc. Amer. Acad. xiv. 298. *E. antisyphilitica*, Watson, Bot. King Exp. 328, t. 39.

From N. Nevada and the eastern base of the Sierra Nevada to the Colorado Valley (Fort Mohave, *Cooper*), Northern Mexico and the Rio Grande. Rather variable, the more northern and western form with the fruit more frequently in pairs and the aments longer pedunculate, but the form with long naked peduncles rare. The older bark usually becomes white and shreddy. Specimens without flowers or fruit from the Santa Inez Mountains (*Brewer*) and Fort Tejon, probably belong to this species, though with distinct persistent scales.

E. ANTISYPHILITICA, C. A. Meyer, of W. Texas and Northern Mexico, has very weak stems several feet long, nearly prostrate or supported by other shrubs, with very short or setaceously tipped distinct subpersistent scales; peduncles very short: bracts of the staminate aments 4 to 6 pairs, of the pistillate 3 or 4 pairs: filaments distinct above: fruit 3 lines long.

* * *Scales 3-lobed and branches ternate: bracts in threes and scarcely connate, of the pistillate aments mostly scarious and more or less unguiculate: fruit solitary, rarely in threes.*

2. **E. Californica,** Watson. Stems decumbent or suberect, the branches not spinose: scales oblong, acutish, sheathing but soon splitting to the base and recurved, long-persistent and often dark-colored, 1½ to 3 lines long: staminate aments globose, sessile, of 4 whorls of nearly distinct bracts: perianth broad, included: filaments (4 or 5) united to the summit: fertile aments sessile, of 4 or 5 whorls of rather rigid reniform-orbicular entire bracts with a very short broad claw: fruit solitary, ovate, 4-angled, acutish, smooth, 3 to 3½ lines long. — Proc. Amer. Acad. xiv. 300.

San Diego County; promontory opposite San Diego and in Jamul Valley, *Palmer*. The other two species of this peculiar group have much more conspicuously scarious bracts with narrow claws scarcely at all connected at base, and are found from S. Utah to the Rio Grande; viz., E. TRIFURCA, Torr., erect, with spinosely tipped branches and conspicuous persistent sheathing acuminate scales (3 to 6 lines long) becoming white and shreddy; staminate perianth cuneate-oblong, included; the fertile aments of numerous whorls of entire bracts 5 or 6 lines long; fruit smooth, 6 lines long: — and E. TORREYANA, Watson, similar but the branches not spinose and the short acutish scales less persistent and not becoming shreddy; staminate perianth round-ovate; fertile aments with fewer (6 or 7 whorls) often crenulate bracts 3 to 5 lines long; fruit scabrous, about 4 lines long.

ORDER CII. TAXACEÆ.

Evergreen trees or shrubs, sparingly resinous, with scaly buds, and (in our genera) scattered linear leaves spreading in 2 ranks, the flowers dicœcious, axillary and solitary, achlamydeous and naked or surrounded by the imbricated and usually decussate bud-scales; staminate flowers with the filaments monadelphous in a column, each filament surmounted by several more or less united pendent anther-cells, dehiscing longitudinally on the lower side; pollen globose: fertile flower of a solitary orthotropous ovule, which in fruit becomes a bony-coated seed raised upon or more or less surrounded by or consolidated with a fleshy disk, cup, or other coating. Embryo axile in fleshy or farinaceous albumen; cotyledons only 2, semiterete.

An order, usually included in the *Coniferæ*, approaching the *Cupressineæ* through the intermediate *Podocarpeæ*. The *Taxaceæ* proper are confined to temperate Asia and America, a single species extending its range through Europe. The larger suborder *Podocarpeæ* are peculiar to the warmer regions of Asia, Africa, Australia and the adjacent islands, and S. America.

1. **Torreya.** Ovule within an urceolate disk perforate at the apex, which becomes drupe-like in fruit. Albumen fleshy, ruminate. Anther-cells 4.
2. **Taxus.** Ovule on an annular disk, which becomes a small berry-like cup surrounding the seed. Albumen farinaceous. Anther-cells 5 to 9.

1. TORREYA, Arnott. Californian Nutmeg.

Flowers solitary, from small scaly buds, nearly sessile, the staminate in adjacent axils along the branchlets, the fertile fewer and more scattered; bud-scales decussately opposite, 4 to 6 pairs, larger in the fertile flowers, acutish, persistent. Stamens naked upon the axis of the male flower, divaricate, subverticillate in 6 or 8 close whorls of four, each stamen with 4 slightly united pendent anthers. Ovule enclosed within a fleshy ovate sac, which becomes large and drupaceous in fruit. Embryo small in the fleshy ruminate albumen. — Trees, with mostly verticillate or opposite spreading or drooping branches, and linear decurrent rigid and mucronate scattered leaves, spreading distichously, not carinate, bisulcate beneath.

Four species are known, belonging to Florida, California, Japan and China, respectively.

1. **T. californica,** Torr. A tree 50 to 75 feet high or more, and 1 to 3 feet in diameter, with slender drooping branches: leaves 1 to 3 inches long by 1½ lines broad, nearly flat, acuminate and pungent, on a short stout appressed petiole (so twisting as to bring the blades into two ranks), bright green and shining above, and with a lighter colored sulcus beneath on each side of the midvein: staminate flowers 4 or 5 lines long, the inner basal scales scarious and toothed; anthers nearly a line long: fruit obovate to oblong-ovate, 1 to 1½ inches long, the fleshy envelope thin and resinous, adnate at base to the nut, which is more or less strongly sulcate longitudinally. — N. Y. Journ. Pharm. iii. 49; Newberry, Pacif. R. Rep. vi. 61, fig. 27 (very poor); Parlatore, DC. Prodr. xvi². 506. *T. Myristica,* Murr. Edinb. New Phil. Journ. x. 7, t. 3; Hook. Bot. Mag. t. 4780.

In the Coast Ranges and Sierra Nevada, from Mendocino and Marin to Yuba and Mariposa Counties, but not abundant. The bark is gray or brown, thin and longitudinally cracked; the wood is light-colored and close-grained; branchlets becoming reddish.

2. TAXUS, Tourn. Yew.

Inflorescence as in *Torreya,* but the flower-buds somewhat smaller, with rounded scales, and the fertile flowers on short scaly peduncles. Stamens fewer (usually 8 or 10) in a globose head, the 5 to 9 small anthers peltately united. Ovule upon a circular disk, which becomes cup-shaped and in fruit globular, fleshy, red and berry-like, surrounding and nearly enclosing but free from the small bony seed. Albumen farinaceous. — Small trees or shrubs, with scattered branches, and similar but carinate leaves; bark scaly.

Seven species are recognized, confined to the temperate and cooler regions of the northern hemisphere, two belonging to the Atlantic Coast, one to the Pacific, and another to the mountains of Mexico. All are very similar and distinguished by slight characters. The wood is only slightly resinous, heavy, tough and elastic, enduring, and capable of a high polish.

1. **T. brevifolia,** Nutt. A tree 20 or 30 feet high (in Oregon 40 to 60 feet high by 2 or 3 feet in diameter), with slender drooping branches: leaves 6 to 12 lines long, acuminate and cuspidate, the margin somewhat revolute, bright green above, glaucous beneath, abruptly narrowed at base into a short slender petiole: staminate aments 1½ lines broad: fruit amber-red, much flattened: seed broadly ovate and somewhat flattened, acute, over 2 lines long. — Sylva, iii. 86, t. 108; Newberry, Pacif. R. Rep. vi. 60, fig. 26. *T. Boursieri,* Carr. Rev. Hort. 1854, 228. *T. Lindleyana,* Murr. in Edinb. New Phil. Journ. i. 294.

In the Sierra Nevada and northward to British Columbia. Much larger than *T. Canadensis* of the Eastern States, which is a low shrub and otherwise distinguished by smaller and more slender staminate aments and by a smaller and less flattened rather oblong-ovate nutlet.

Order CIII. CONIFERÆ.

Resinous and mostly evergreen trees or shrubs, with usually awl- or needle-shaped or scale-like mostly rigid leaves, and monœcious or rarely diœcious achlamydeous flowers; male flowers reduced to the stamens only, which are indefinite in number and often numerous, the filaments upon a central axis, with the anther-cells (2 or more) either adnate to the back of the connective or suspended from the under side of its scale-like or peltate summit, the cells dehiscing variously; fertile aments consisting of few or many scales, becoming a dry cone in fruit or fleshy and berry-like (in *Juniperus*); ovules naked, 2 or more, at or on the base of each scale, adnate or free, erect or inverted; seeds naked or winged, with chartaceous or crustaceous or sometimes bony testa. Embryo straight, axile in fleshy oily albumen; cotyledons 2, or often several in a whorl.

A large and most important order, cosmopolitan, but found most abundantly in the temperate and cooler portions of the northern hemisphere; valuable above all others for its timber and for its resinous products (the *Abietineæ* especially), and very extensively planted for shade and ornament. The following tribes and genera are represented in California, the chief remaining tribe *Araucarieæ* largely replacing them in the southern hemisphere. The morphology of the flowers in this order has been the subject of much controversy, and some points are still by no means settled. It is now generally admitted, however, that the staminate inflorescence is to be considered as a single polyandrous flower, rather than as an ament, and that view is here adopted, though it is found convenient to occasionally make use of the ordinary terminology in the descriptions. The distinction of bracts and carpellary scales in the female aments, which is so evident in the *Abietineæ*, is obscure in the preceding tribes, the two organs being consolidated into one body in the *Taxodineæ*, while in the *Cupressineæ* the presence of anything corresponding to a carpellary scale may be considered as questionable, the existing "scale" answering pretty evidently to the "bract" of the *Abietineæ*.

Tribe I. CUPRESSINEÆ. Scales of the fertile ament few, decussately opposite, apparently simple, becoming a small cone or connate into a drupe-like *galbulus*. Ovules 2 to several in their axils, orthotropous and erect. Cotyledons 2, very rarely more. Anther-cells 2 to 8, introrse on the lower part of the face of the more or less peltate connective-scale: pollen-grains simple. Leaves decussately opposite or ternate, often dimorphous, usually scale-like and mostly adnate, the earlier free and subulate: leaf-buds not scaly.

* Flowers diœcious: fruit drupe-like with bony ovate seeds: leaves opposite or in threes; foliage never 2-ranked.

1. **Juniperus**. Ovules in pairs or solitary at the base of the fleshy (4 to 6, or 3 to 9) scales. Seeds 1 to 5 or more. Berry globose, reddish, or blue or blackish, ripening the second year.

* * Flowers monœcious: fruit a cone: leaves opposite.

\+ Cone subglobose, of spreading peltate or wedge-shaped scales: seeds 1 or more to each scale, angled or narrowly winged.

2. **Cupressus**. Seeds several to each thickened woody peltate scale, maturing the second year. Foliage never 2-ranked.
3. **Chamæcyparis**. Seeds 1 or 2 to each thin scale, maturing the first year. Leaves and branches more or less 2-ranked.

\+ \+ Cone oblong, of imbricated or valvate oblong scales: seeds 2 to each scale, maturing the first year: foliage 2-ranked.

4. **Thuya**. Scales 8 to 12, rather thin, imbricate. Seeds equally 2-winged.
5. **Libocedrus**. Scales 6, thick-coriaceous and valvate, only the middle pair fertile. Seeds unequally 2-winged.

Tribe II. TAXODINEÆ. Scales of the fertile aments more numerous and spirally arranged, in fruit forming a woody cone. Ovules erect or in some genera inverted. Leaves alternate. Otherwise as *Cupressineæ*, and intermediate between that tribe and the *Abietineæ*.

6. **Sequoia**. Tall trees, with short-linear to ovate-lanceolate acute carinate leaves, and ovate cones with thick wedge-shaped spreading scales.

TRIBE III. ABIETINEÆ. Scales of the fertile aments numerous, spirally imbricated, carpellary, each in the axil of a thin distinct persistent bract (in flower often exceeding and in fruit mostly exceeded by the scale), in fruit becoming coriaceous or ligneous and forming a *strobile* or cone. Ovules 2, adnate to the inner face of each scale near the base, inverted. Seeds separating from the scale at maturity, carrying away a conspicuous scarious wing. Cotyledons 3 to 16. Male flowers spirally arranged and subtended by involucral scales. Anther-cells 2, extrorse, parallel and contiguous upon the sides of a very narrow connective which is often surmounted by a scarious dilated inflexed tip. Leaves scattered, or fascicled in *Pinus*, from linear to needle-shaped : leaf-buds scaly.

* Cones maturing the first year, their bracts remaining membranaceous : leaves solitary, mostly entire : flowers on last year's branchlets.

+ Branchlets smooth, the leaf-scars not raised : bracts of the female ament much larger than the scales.

7. **Abies.** Leaves sessile, leaving circular scars. Cones erect, their scales deciduous from the axis. Seeds with resin-vesicles.
8. **Pseudotsuga.** Leaves petioled, the scars transversely oval. Cones pendulous, their scales persistent on the axis. Seeds without resin-vesicles.

+ + Branchlets rough from the prominent persistent leaf-bases : bracts of the female ament smaller than the scales : cones pendulous, their scales persistent on the axis.

9. **Tsuga.** Leaves petioled, with a single dorsal duct. Seeds with resin-vesicles.
10. **Picea.** Leaves sessile, keeled on both the upper and lower sides, with two lateral (sometimes incomplete) ducts. Seeds without resin-vesicles.

* * Cones maturing in the second year, their bracts becoming corky and thickened : leaves of the perfect plant in bundles of 2 to 5 (rarely solitary) from the axil of scarious bracts, their base surrounded by a sheath of scarious bud-scales, usually serrulate.

11. **Pinus.** Pollen 2-lobed. Resin-ducts inconstant in number and variously placed.

LARIX OCCIDENTALIS, Nutt. Sylva, iii. 143, t. 120 (*Pinus Nuttallii*, Parlat. in DC. Prodr. xvi^2. 412), the Western Larch, occurs on the headwaters of the Deschutes River, Oregon, and northward to British Columbia, but has not been seen in California. The genus is distinguished from *Abies* chiefly by the small cones with persistent scales and bracts, mostly vertical on the slender drooping branches and crimson when in flower, and conspicuously by the deciduous soft and very slender leaves, flattened or somewhat tetragonal, and mostly fascicled at the extremities of short lateral undeveloped branchlets. L. OCCIDENTALIS is a tall slender tree (sometimes 150 feet high), with glabrous branchlets and nearly glabrous bud-scales, and ovoid cones nearly an inch in length, the conspicuous bracts with an excurrent foliaceous midvein usually exceeding the scale. *L. Lyallii*, Parlat., in the Cascade Mountains of Washington Territory, is a smaller tree with densely pubescent bud-scales and branchlets, and with longer and more oblong cones.

1. JUNIPERUS, Linn. JUNIPER.

Flowers dicœcious or sometimes monœcious, the small solitary aments axillary, or terminal upon short lateral branchlets; scales few and (like the leaves) decussately binate or ternate. Staminate flowers oblong-ovate; anther-cells 4 to 8 under each shield-shaped scale. Fertile ament of 2 or 3 series of fleshy scales, with 2 erect ovules to each scale, in fruit becoming united into a blue-black or reddish drupe, ripening the second year. Seeds 1 to 12, ovate, bony. Cotyledons 2 (in a single species more). — Low shrubs or trees, with mostly thin shreddy bark, and with evergreen binate or ternate, free and subulate or adnate and scale-like leaves; branches and leaves not 2-ranked.

A genus of the northern hemisphere, including 20 species belonging to the Old World (of which two are also American), 4 Mexican and W. Indian species, and as many peculiar to the United States. The wood of all the species is fine-grained, not resinous, exceedingly durable, the heart-wood usually reddish and more or less fragrant.

* *Aments axillary: leaves ternate, free and jointed at base, linear-subulate, pungent, channelled and white-glaucous above, not glandular-pitted.* — OXYCEDRUS, Spach.

1. **J. communis,** Linn. A shrub or small tree, with spreading or pendulous branches: leaves rigid, more or less spreading, 5 to 9 lines long: fruit dark-blue, 3 lines in diameter or more, 1–3-seeded. — Var. **alpina,** Gaud. Low and decumbent or prostrate: leaves shorter (2 to 4 lines long) and less spreading.

This Old World species occurs throughout British America, ranging southward in the mountains to N. Carolina and New Mexico. The variety is found in the Sierra Nevada (Mono Pass, *Brewer*) and in the Northern Coast Ranges (Del Norte County, *Bolander*), as well as eastward to Maine, and is scarcely more than a reduced form of the species.

* * *Aments terminal on short lateral branchlets: leaves ternate (or opposite), of two forms, mostly adnate and scale-like, closely appressed and crowded upon the branches and often glandular-pitted, occasionally more distant, free and subulate.* — SABINA, Spach.

+ *Fruit reddish, dry and sweetish.*

2. **J. Californica,** Carr. A shrub or small tree (sometimes 20 to 35 feet high), conical, with stout spreading branches and thick branchlets: leaves ternate, short and thick, mostly acute: fruit oblong-ovate, 5 to 7 lines long, of 6 or rarely 4 scales, usually 1-seeded: seed 4 to 6 lines long, very thick and bony, smooth, often angled or grooved, brown with a whitish 2–3-lobed hilum: cotyledons 4 to 6. — Rev. Hort. iii. 352; Engelm. Trans. Acad. St. Louis, iii. 588. *J. tetragona,* var. *osteosperma,* Torr. Pacif. R. Rep. iv. 141. *J. Cerrosianus,* Kellogg, Proc. Calif. Acad. ii. 37. *J. occidentalis,* Parlatore, DC. Prodr. xvi². 489, in part.

Var. **Utahensis,** Engelm. l. c. Branchlets more slender: fruit globose and smaller, 3 or 4 lines in diameter. — *J. occidentalis,* Watson, Bot. King Exp. 336, mainly.

The typical form is found chiefly in the Coast Ranges, from the Sacramento to San Diego; the variety is frequent from the Sierra Nevada through Nevada in the mountains to Arizona and S. Utah. An original fruiting specimen of *J. andina,* Nutt., in herb. Gray, belongs here. Specimens collected by *Dr. E. Palmer* in Guadalupe Island have large globose bluish fruit.

+ *Fruit smaller, blue-black, resinous-fleshy.*

3. **J. occidentalis,** Hook. Much resembling the variety of the last species, from which it is distinguished chiefly by the blue and resinous fruit, which is 3 or 4 lines in diameter: seeds 1 to 3, deeply pitted: cotyledons 2. — Fl. Bor.-Am. ii. 166; Engelm. l. c. 590. *J. andina,* Nutt. Sylva, iii. 95, t. 110?

Oregon, Idaho, and southward in the Sierra Nevada, at a rather higher elevation than the last.

2. CUPRESSUS, Tourn. CYPRESS.

Flowers monœcious. Aments terminal, of few decussately opposite scales. Staminate flowers small; anther-cells 3 to 5 under each ovate obtuse subpeltate scale; pollen-grains simple. Fertile aments erect on short lateral branchlets, of 6 to 10 very thick peltate valvate scales, becoming a globose or subglobose woody cone, maturing the second year. Ovules numerous, in several rows at the base of the scales, erect. Seeds acutely angled. Cotyledons 2 to 4. — Evergreen trees, with small scale-like adnate and appressed decussately opposite and imbricated leaves, usually glandular-pitted; branches and leaves not 2-ranked.

In the Old World 4 or 5 species are found in Central Asia and the Mediterranean region, while in America the genus is confined to the Western Coast, 3 or 4 species being Mexican, and the rest belonging to California. The wood resembles that of *Juniperus,* being close-grained, fragrant and durable.

1. **C. macrocarpa,** Hartw. A tree (becoming 40 to 70 feet high), with rough bark, spreading horizontal branches, and flattened top; the branches with dark gray and somewhat rugose bark; branchlets rather stout: leaves bright green, acutish,

obscurely pitted on the back, often with a longitudinal furrow on each side: scales of very young cones with conspicuous foliaceous tips; mature cones clustered on short stout peduncles, oblong-ovate (1 to 1½ inches long by 9 lines broad), of 5 or usually 6 pairs of scales, with a broad thickish or on the uppermost a subconical boss: seeds numerous (about 20 to each scale), mostly 2½ lines long. — Journ. Hort. Soc. ii. 187; Gordon, same, iv. 296, with fig.; Torr. Bot. Mex. Bound. 211; Parlatore, DC. Prodr. xvi². 473. *C. Lambertiana*, Gord.; Carr. Conif. 124. *C. Hartwegii*, Carr. Conif. 2 ed. 168.

On granite rocks near the sea, from Point Pinos near Monterey southward 4 or 5 miles to Pescadero Ranch. The trees at this the only certain locality very much resemble the Cedar of Lebanon in habit, with dense far-spreading branches. The largest measurement recorded (by Prof. W. H. Brewer) is a circumference of 18½ feet at a height of 5 or 6 feet from the ground. It was early introduced into England and is there frequent in cultivation under various forms and names.

2. **C. Goveniana**, Gordon. A shrub or small bushy tree, 6 to 10 feet high or more; branches spreading and somewhat pendulous; branchlets rather more slender than in the last, and the leaves slightly smaller, thick and mostly without lateral depressions, the dorsal gland often wanting or very obscure: mature cones smaller, globose (8 to 10 lines in diameter), of 6 or 8 scales: seeds mostly 1½ to 2 lines long. — Journ. Hort. Soc. iv. 296, with fig.; Torr. Bot. Mex. Bound. 211; Parlat. l. c. 472.

In the Coast Ranges from about Monterey to Sonoma County. In Marin County it is said to sometimes attain a height of 40 or 50 feet (*G. R. Vasey*). A doubtful form is reported from Cedar Mountain, Alameda County (*Dr. Kellogg*), described as a handsome tree 30 or 40 feet high, of dense symmetrical growth; the globose cones have 6 very thick scales with stout prominent bosses. To this species also probably belongs the cypress of the mountains of San Diego County, which is a low and slender tree, 15 or 20 feet high, with nearly smooth reddish bark, and slender branchlets: leaves with usually a conspicuous gland; cones rather large (9 to 12 lines in diameter), globose, with 6 very thick scales; seeds very numerous, 2 lines long.

C. Guadalupensis, Watson, is another similar species, of Guadalupe Island (*Palmer*), a widely spreading tree, 40 feet high or more and 2 to 5 feet in diameter, the bark flaking off in thin plates and leaving a smooth claret-red surface: branches drooping and branchlets very slender: foliage glaucous-green; glands obscure: cones globose and strongly bossed, an inch or more in diameter, of 6 or 8 very thick scales: seeds large, 3 lines long or more. In cultivation about San Francisco, and will probably prove a valuable ornamental tree.

3. **C. Macnabiana**, Murr. A shrub or small tree (6 to 10 feet high or more), with numerous short slender branchlets: leaves very small, deep green and somewhat glaucous, conspicuously pitted on the back: mature cones small (6 to 8 lines in diameter), subglobose; scales 6, or rarely 8, with thin prominent bosses, the uppermost usually very prominent and incurved: seeds very numerous, 1½ or mostly 2 lines long. — Edinb. New Phil. Journ. i. 293, t. 10; Parlat. l. c. 473.

About Clear Lake (*Torrey, Bolander*); originally reported by Jeffrey from Mount Shasta at 5,000 feet altitude.

3. CHAMÆCYPARIS, Spach.

With the characters of *Cupressus*, but with flattened 2-ranked branchlets and the small globose cones maturing the first year; seeds few (1 to 4) at the base of each obpyramidal thinner scale, angled or more or less winged; anther-cells 2 or 3 to each connective-scale. — *Retinospora*, Sieb. & Zucc.

Represented in the Atlantic States by a single species, and by 4 or 5 species in Japan and Eastern Asia, besides the following of the Pacific Coast.

1. **C. Lawsoniana**, Parlat. A tree, often tall (sometimes 100 to 150 feet high by 2 to 6 feet in diameter), with slender spreading or pendulous branches: leaves small, deep green, with a glaucous margin when young, acute or acutish, more or less glandular-pitted: cones 4 lines in diameter, glaucous when young, of 8 or 10 scales with the flattened summit crossed by a narrow transverse ridge acute in the middle: seeds

2 to 4 to each scale, wing-margined, 2 lines long. — DC. Prodr. xvi². 464. *Cupressus Lawsoniana*, Murr. Edinb. New Phil. Journ. i. 292, t. 9; Hook. f. Bot. Mag. t. 5581. *Cupressus Nutkanus*, Torr. Bot. Wilkes, t. 16. *Cupressus fragrans*, Kellogg, Proc. Calif. Acad. i. 103. *Cupressus attenuata*, Gordon, Pinet. 57.

A handsome tree, in moist grounds, in the Shasta Mountains and northward in the Coast Ranges of Oregon, very valuable for its timber and admired in cultivation. The wood is white and very fragrant, fine and close-grained, free of knots and easily worked, elastic and very durable. It is known as "Oregon" or "White Cedar," and also as "Ginger Pine." It is extensively cultivated for ornament, and numerous garden varieties have been produced.

C. NUTKAENSIS, Spach, a more northern species of the coast from the Columbia River to Alaska, probably does not reach California. It is distinguished by its less slender habit and less flattened branchlets, with larger more acute leaves, obscurely glandular; cones somewhat larger, of 4 or 6 more convex scales (thicker and greener) with very prominent central bosses.

4. THUYA, Tourn. ARBOR-VITÆ.

Flowers monœcious. Aments terminal, of few scales decussately imbricated in pairs. Staminate flowers numerous, very small, with 3 or 4 anthers under each of the 4 or 6 subpeltate broadly ovate pointed scales; pollen-grains simple. Fertile aments terminating stouter branchlets, of 8 to 12 erect scales, with a pair of collateral erect ovules at the base of each: cone soon strongly reflexed, maturing the first season, small, ovate and cinnamon-colored; the thin-coriaceous scales ovate, slightly mucronate at the apex, the lowest and uppermost pairs sterile. Seeds lanceolate and somewhat compressed, made suborbicular by nearly equal lateral wings. Cotyledons 2. — Evergreen trees, with thin fibrous bark, scattered branches and distichous foliage; leaves opposite, adnate and imbricate in 4 rows, oblong, with free acute tips, somewhat dimorphous.

Only three species are known, closely similar to each other, of which one belongs to the Atlantic States and one to Japan.

1. **T. gigantea**, Nutt. A tall graceful tree (often 100 to 250 feet high or more, and 3 to 12 feet in diameter), narrowly pyramidal, with spreading and somewhat drooping branches: foliage light green and shining; leaves acuminate and subpungent, very obscurely glandular: male flowers a line long: cones somewhat clustered near the ends of the branches, a half-inch long, the scales with a thin acute usually appressed mucro: seeds a little shorter than the wings, which are 3 lines long, distinct, and slightly unequal. — Journ. Philad. Acad. vii. 52, and Sylva, iii. 102, t. 111; Newberry, Pacif. R. Rep. vi. 56, fig. 22; Parlatore, DC. Prodr. xvi². 457. *T. plicata*, Donn; Parlat. l. c. *T. Menziesii*, Dougl.; Carr. Conif. 106.

A fine tree, frequent in the Coast Ranges and Cascade Mountains of Oregon, but rather rare in California. It is said to range from San Diego County to Sitka. It has much resemblance to the *Libocedrus*, except in fruit, and may readily be confounded with it. The eastern species, *T. occidentalis*, is smaller and much less graceful, and has more conspicuously glandular leaves and smaller cones with scarcely mucronate scales. The wood is soft, fine-grained, light-colored, easily split and very durable.

5. LIBOCEDRUS, Endl. WHITE CEDAR of California.

Staminate flowers with 12 or more filament-scales. Cones not reflexed, of 4 or 6 erect subverticillate and somewhat valvate thick-coriaceous scales, the lower pair smaller and sterile, the third pair (when present) also sterile and connate. Seeds very unequally winged. Otherwise as *Thuya*.

Only four species are recognized, of which two are natives of South America from Chili to Cape Horn, and one is found in New Zealand. Our species differs so far from the others as to have

been separated by Koch under the name of *Heyderia*, the chief differences being the third connate pair of scales in the cone, the somewhat differently winged and shaped seed, and the arrangement of the leaves in four ranks.

1. **L. decurrens**, Torr. A tall tree (becoming 100 to 150 feet high or more, by 4 to 7 feet in diameter), with scattered lax spreading branches: leaves bright green, in two decussate pairs at each joint, closely adnate excepting the short acute tip; the lateral without glands and nearly covering the flattened obscurely pitted inner ones: staminate flowers ovate, of 12 to 16 scales: cones 9 to 12 lines long, scaly-bracteate at base, oblong, the lower scales very short, the upper connate into a longitudinal septum, the middle pair oblong, convex, obtuse at the tip, all with a short acute somewhat recurved mucro: seeds oblong-lanceolate, 4 to 6 lines long, the narrow outer wing scarcely longer, the inner one broad and nearly equalling the scale. — Pl. Frem. 7, t. 3; Parlatore, DC. Prodr. xvi². 456. *Thuya Craigiana*, Balf. Oreg. Exp. 2, t. *T. gigantea*, Carr. Fl. Serres, ix. 199, fig. 3–5, and Conif. 105. *Heyderia decurrens*, Koch, Dendrol. ii. 177.

In the Coast Ranges from Oregon to San Diego and in the Sierra Nevada to an altitude of 8,500 feet or more; in foliage and habit much resembling *Thuya gigantea*. The tree is conical in shape, with loose somewhat fibrous bark: wood very light and soft, light-colored, durable in water or under cover, but said to decay when exposed.

6. SEQUOIA, Endl. Redwood. Mammoth Tree.

Flowers monœcious. Aments terminal or axillary upon young shoots, of rather numerous spirally arranged scales. Staminate flowers small, involucrate with scale-like leaves, with 3 to 5 anthers under each ovate subpeltate connective-scale; pollen-grains simple. Fertile aments oblong-ovate, erect, with 3 to 7 inverted ovules at the base of the spreading scales. Cone maturing the second year, woody, oval; the scales divergent at right angles from the axis, thick and wedge-shaped with a rhomboidal rugose umbilicate apex, setaceous-mucronate. Seeds compressed, oblong-obovate, with thick spongy margin. Cotyledons 4 to 6. — Tall trees, with straight columnar trunk and short spreading branches; leaves scattered, decurrent, short-linear to ovate-lanceolate, compressed and carinate, acute, the upper mostly spreading distichously (especially on younger trees and branches); bark very thick and fibrous-spongy, cleaving longitudinally; wood red, soft and easily split. — *Wellingtonia*, Lindl.

A remarkable and noted Californian genus.

1. **S. sempervirens**, Endl. Leaves bright green, glaucous beneath, spreading distichously, acute or acuminate and mostly pungent, 6 to 9 lines long and about a line broad; those on the main stems and peduncles, and usually the lower ones on the spreading branchlets, appressed and shorter: staminate flowers 1½ to 2 lines long: cones oblong, 9 to 12 lines long by a half-inch broad, of about 20 scales: seeds brown, 2 or 2½ lines long. — Syn. Conif. 198; Decaisne, Rev. Hortic. 1855, 9, t. 11, fig. 2; Newberry, Pacif. R. Rep. vi. 57, fig. 23; Parlatore, DC. Prodr. xvi². 436; Bolander, Proc. Calif. Acad. iii. 231. *Taxodium sempervirens*, Lambert, Gen. Pin. 2 ed. 107, t. 48, & 3 ed. 120, t. 64. *Schubertia sempervirens*, Spach.

The most valuable tree of the Californian forests, occupying the Coast Ranges with few breaks from Oregon to San Luis Obispo, wherever they are exposed to the fogs from the ocean, but most extensively northward of San Francisco. In size it usually averages 8 to 12 feet in diameter and from 200 to 300 feet in height, with a straight cylindrical trunk naked to the height of 70 or 100 feet or more. The bark is of a bright cinnamon color, 6 to 12 inches thick, and the wood a rich brownish red, light but strong and durable, straight-grained and taking a handsome finish. The species is remarkable for its tenacity of life, the roots and stumps of the older trees being almost

indestructible. Universally known as the "Redwood." It was first discovered by *Menzies* on Vancouver's voyage (about 1794), and not again noticed until collected by *Douglas* in 1833.

2. **S. gigantea,** Decaisne. Leaves paler and smaller, not distichous, slightly spreading or closely appressed, ovate-acuminate or lanceolate, rigid and pungent, the free portion 1 to 3 lines long; on very young plants linear and much narrower, more spreading: branchlets pendulous: staminate flowers 2 or 3 lines long: cones ovate-oblong, 2 or 3 inches long, of usually 25 to 30 scales, which are 8 to 14 lines long by 3 to 6 broad: seeds 3 to 7 to each scale, brownish, 2 to 3½ lines long. — Bull. Bot. Soc. France, i. 71, and Rev. Hortic. 1855, 9, t. 10, fig. 1; Torrey, fide Gray, Amer. Journ. Sci. 2 ser. xviii. 286; Parlat. l. c. 437; Muir, Proc. Amer. Assoc. xxv. 242. *Wellingtonia gigantea,* Lindl. in Gard. Chron. 1853, 823; Hook. Bot. Mag. t. 4777, 4778; Naudin, Fl. Serres, ix. 93, t. 892, & 121, t. 903. *Washingtonia Californica* (or *Taxodium Washingtonianum*), Winslow, Calif. Farmer, Sept. 1854 (Kew Journ. Bot. vii. 29). *Sequoia Wellingtoniana,* Seem. in Bonpl. iii. 27. *Taxodium giganteum,* Kell. & Behr, Proc. Calif. Acad. i. 53.

The "Big Tree," and pride of the Californian woods, occurring in groves or isolated groups, always accompanied, however, by other trees, along a line some 240 miles in length, extending from near the southern border of Tulare to a little north of the south line of Placer County. Toward the north the groves become smaller, although the individual trees retain their full size. This is the largest and tallest tree known to exist on the American continent. The height of the highest one yet discovered, which is in the Calaveras Grove, is 325 feet. One of the finest and largest trees of this grove was cut down, and its age ascertained to be about 1300 years; it is possible that others considerably exceed this in age, as for instance the so-called Grizzly Giant of the Mariposa Grove, which is a little over 93 feet in circumference at the ground. The present species is less graceful than the last, having shorter branches and paler appressed leaves. The bark on the lower portion of the trunk becomes very thick (1 or 2 feet); the color of the wood is a duller red. For a fuller account of this tree see Whitney's "Yosemite Guide-Book."

Tribe III. ABIETINEÆ. (By Dr. George Engelmann.)

7. ABIES, Link. Fir.

Flowers from the axils of last year's leaves: male flowers in the form of an oval or cylindrical staminеal column, its short stipe surrounded by numerous bud-scales; commissure of the anthers terminating in a knob; cells bursting transversely; pollen-grains large (.05 to .07 line long), with 2 air-sacs. Female aments erect, the bract much larger than the scale. Cones maturing in the first year, erect, their scales and enclosed or exsert membranaceous bracts falling at maturity from the persistent axis. Seeds covered with resin-vesicles and partially but permanently enclosed in the pergamentaceous base of the wing, which covers the outer and laps over upon the inner surface. Cotyledons normally 4 to 10. — Magnificent trees, of pyramidal form and rapid growth, but with brittle and easily decaying wood; leaves sessile, with a circular never prominent base, mostly more or less flattened and often emarginate, on the horizontal branchlets appearing 2-ranked by a twist near the base, bearing stomata only or mainly on the lower surface, with two longitudinal resin-ducts mostly close to the epidermis of the lower side or, in some species, within the parenchyma. — Engelm. in Trans. St. Louis Acad. iii. 593. *Abies,* Tournefort, in part. *Pinus,* Linn., in part. *Pinus,* sect. *Abies,* Endlicher; Parlatore. *Picea,* Don.

The 16 or 18 species of this genus are confined to the mountainous regions of the northern hemisphere, one half to the Old, the other half to the New World. Of these two are found northward and eastward, one in Mexico, and the rest in the mountains of the Pacific slope.

* *Leaves flat or flattish.*

+– *Upper side of the leaves dark green, glossy and without stomata.*

++ *Leaves acute: linear tip of the bracts long-exserted.*

1. **A. bracteata,** Nutt. A tall slender strictly pyramidal tree, 100 to 150 feet high and 1 or 2 feet in diameter, with brown bark: leaves mostly somewhat 2-ranked, linear or linear-lanceolate, an inch or two long by 1 to 1½ lines wide, with two pale (or in young leaves white) bands beneath: cones oval to subcylindric, 3 or 4 inches long and 1½ to 2 inches thick; bracts cuneate-obcordate, scarcely exceeding the transversely oval glabrous scales, terminating in elongated linear foliaceous midribs or awns (1 to 1½ inches long): seeds as long as the obovate rounded wing. — Sylva, iii. 137, t. 118; Hook. Bot. Mag. t. 4740; Murr. in Edinb. New Phil. Journ. x. 1, t. 2; Engelm. l. c. 601. *Pinus venusta,* Dougl. in Comp. Bot. Mag. ii. 152. *P. bracteata,* Don, Trans. Linn. Soc. xvii. 442. *Picea bracteata,* Loud.

Thus far only known from the Santa Lucia Mountains, at an elevation of 3,000 to 6,000 feet. The pointed buds are unusually large for the genus (about half an inch long), covered with imbricated scales.

++ ++ *Leaves obtuse or emarginate: bracts enclosed.*

2. **A. grandis,** Lindl. Very tall (200 to 300 feet high and 3 or 4 feet in diameter), with smooth brownish bark: leaves channelled above and glossy, with two pale or white bands beneath, an inch or two long and somewhat 2-ranked on the younger or lower branches, on the higher branchlets shorter, somewhat cuneate, and crowded on their upper side: cones cylindric, retuse, 2 to 4 inches long, with scales (13 or 14 lines wide) nearly twice broader than high, the quite short obcordate or 2-lobed bracts with or without a short point: wing of the seeds very oblique, about as broad as long. — Penny Cyc. i. 30; Engelm. l. c. 598. *Pinus grandis,* Dougl.; Parlat. *P. amabilis,* Dougl.? not of later authors. *Picea grandis,* Loud. Arbor. iv. 2341, fig.; Newberry, Pacif. R. Rep. vi. 46, fig. 16 and t. 6.

Confined principally to the northern Pacific Coast, where it extends from British Columbia to Northern California, as far south as Mendocino. Probably the largest fir known; in Oregon one of the important timber-trees, though the wood is inferior to that of the Douglas and Sitcha spruces. Readily distinguished from the mountain firs by the glossy green upper surface of the leaves, and by the other characters enumerated above.

+– +– *Leaves pale and with stomata on both sides.*

3. **A. concolor,** Lindl. A large tree, 80 to 150 feet high with a diameter of 2 to 4 feet, with rough grayish bark: leaves mostly obtuse, pale green, those of younger trees and lower branches elongated, 2 to 2½ and even 3 inches long, 2-ranked, often slightly channelled and notched, those of old trees and of upper cone-bearing branches shorter (an inch long), broader, thicker, convex above and often falcate, covering the upper side of the branchlets: cones oblong-cylindrical, 3, 4, or even 5 inches long and 1¼ to 1¾ inches in diameter, pale green or sometimes dull purplish; scales (12 to 15 lines wide) nearly twice wider than high; bracts short, enclosed, truncate or emarginate, with or without a short mucro: wing of the seeds oblique, as long as broad: cotyledons 5 to 7. — Journ. Hort. Soc. v. 210; Engelm. l. c. 600, and Wheeler's Rep. vi. 255. *Picea concolōr,* Gordon, Pin. 155. *Pinus concolor,* Engelm.; Parlat. in DC. Prodr. xvi². 426. *Abies Lowiana,* Murr. *A. grandis* of the Californian botanists. *A. amabilis* (!), Watson, Bot. King Exp. 333.

A common fir throughout the Californian Sierras, from 3,000 or 4,000 to 8,000 feet elevation, extending into Southern Oregon and through the mountains of Arizona to Utah and S. Colorado. Always readily recognized by the gray bark of the trunk (whence often called in California "White Fir"), and by the pale color of the foliage, which at last becomes dull green. A very ornamental tree, especially the paler variety, but the timber is not much esteemed. *A. Lowiana,* known also in nurseries as *A. Parsoniana, lasiocarpa* and *amabilis,* distinguished by its longer flatter straighter leaves with fewer stomata on the upper side, is a young and vigorous state of this species, which has not yet fruited in cultivation.

* * *Leaves more or less quadrangular, short and curved upward.*

+ *Bracts exsert.*

4. **A. nobilis,** Lindl. A magnificent tree, 200 feet high, with thick cinnamon-brown bark (red inside): leaves rigid, curved upward, covering the upper side of the branchlets, glaucous and stomatose and keeled both on the upper and under side, acute or obtuse, about an inch long, only on the youngest trees or lowest branches longer (1½ inches), flatter, slightly grooved and somewhat 2-ranked: cones cylindrical-oblong, thick, 6 to 9 inches long by 2½ or 3 inches broad, obtuse, almost covered by the exsert reflexed cuneate cuspidate bracts; scales comparatively narrow (1½ inches wide, by an inch long or more): seeds slender, with a cuneate-triangular somewhat retuse wing: embryo with 7 or 8 cotyledons. — Penny Cyc. i. 30; Nutt. l. c., t. 117; Engelm. l. c. 601. *Pinus nobilis,* Dougl.; Parlat. *Picea nobilis,* Loud. l. c. 2342, fig.; Newberry, l. c. 49, fig. 17.

The "Red Fir" of Northern California, forming large forests about the base of Mount Shasta, at 6,000 to 8,000 feet altitude, and extending through the Cascade Mountains to the Columbia River. The timber is said to be better than that of other firs. Forms are found with almost enclosed bracts, often accompanying the others, which may connect with the following species.

+ + *Bracts enclosed.*

5. **A. magnifica,** Murray. Similar to the last, even more than 200 feet high and 8 to 10 feet in diameter, with the same kind of thick red-brown bark, and with similar very rigid foliage, but the leaves never grooved nor notched even on the young trees, on older branches shorter and thicker, so that they are mostly only a fourth wider than thick or even perfectly square, and often only 6 to 9 lines long: cones 6 to 8 inches long, 2½ to 3¼ inches thick, purplish brown; bracts lanceolate, acuminate, shorter than the very wide scales, which are 1½ to 1¾ inches broad by scarcely an inch high: seeds slender, the wing broader, very obliquely obovate-cuneate: cotyledons 8 to 10. — Proc. Hort. Soc. iii. 318; Engelm. l. c. 601. *Abies amabilis* of Californian botanists.

The "Red Fir" of the higher Sierras is not rare at an altitude of 7,000 to 10,000 feet, but forms no forests by itself. Easily distinguished from the last by the enclosed bracts. Forms, however, are said to occur (Mount Silliman, *Brewer*) with exsert bracts, and it remains to be seen whether the slight differences in the leaves, scales and seeds will suffice to keep the species separate.

8. PSEUDOTSUGA, Carrière. Douglas Spruce.

Flowers from the axils of last year's leaves. Male flowers an oblong or subcylindrical staminеal column, surrounded and partly enclosed by numerous conspicuous orbicular bud-scales; commissure of the anthers terminating in a short spur, the cells opening obliquely by one continuous slit: pollen-grains ovate-subglobose. Female flowers with the scales much shorter than the broadly linear acutely 2-lobed and long-pointed or aristate bracts. Cones maturing in the first year, with persistent scales and exsert bracts. Seeds without resin-vesicles, the wing at last breaking off. Cotyledons 6 to 12. — A very large tree, at first pyramidal and spruce-like, often at last more spreading, with yellow or reddish rather coarse but very valuable wood, which is distinguished from that of all the allied conifers by the abundance of spirally marked wood-cells. Leaves flat, distinctly petioled, somewhat 2-ranked by a twist at the base, stomatose only on the lower surface, with two lateral resin-ducts close to the epidermis of the under side, leaving on the branchlets scarcely prominent transversely oval scars. — Conif. 2 ed. 256. *Pinus,* sect. *Tsuga,* Endl., in part; Parlat. *Abies,* Lindl., in part.

A single species, which extends through the Rocky Mountains and mountains of California, from Oregon far into Mexico, and is in Oregon the largest and most important timber-tree.

1. **P. Douglasii,** Carr. l. c. A gigantic tree (200 to over 300 feet high and 8 to 15 feet in diameter), with very thick brown deeply fissured bark: leaves linear, distinctly petioled, mostly obtuse or obtusish, 8 to 12 lines long, or on robust shoots even 16 lines long, by $\frac{3}{4}$ line wide: male flowers oblong-cylindrical, 5 to 10 lines long, half enclosed in large loose orbicular involucral scales: cones 2 to 3 or rarely 4 inches long, subcylindrical; bracts more or less exsert and spreading or reflexed: seeds triangular, on the upper side convex and reddish brown, on the lower flat and white, 3 lines long; wings 3 to $4\frac{1}{2}$ lines long, broadest at base, acutish: cotyledons 6 to 8. — Engelm. in Wheeler's Rep. vi. 257. *Pinus Douglasii,* Sabine; Hook. Fl. Bor.-Am. ii. 162, t. 183; Parlat. in DC. Prodr. xvi^2. 430. *Abies Douglasii,* Lindl.; Nutt. Sylva, iii. 129, t. 115; Newberry, Pacif. R. Rep. vi. 54, t. 8. *Tsuga Douglasii,* Carr.

Var. **macrocarpa.** A smaller tree, 40 to 50 or rarely 80 feet high, $1\frac{1}{2}$ to 2 or 3 feet thick, with long spreading branches, and narrower often acutish leaves: male flowers nearly an inch long: cones 5 to 7 inches long, 2 inches thick; scales large in proportion; bracts not as long as in the typical form: seeds and wing both 5 lines long: cotyledons 9 to 12. — *Abies Douglasii,* var. *macrocarpa,* Torr. in Ives' Rep. 28. *A. macrocarpa,* Vasey in Gard. Monthly, Jan. 1876.

Throughout the Coast Ranges and in the Sierra Nevada up to 6,000 or 8,000 feet, and also northward near the coast, attaining its largest proportions in Oregon, and extending in a smaller form to the Rocky Mountains. A beautiful tree, readily distinguished by its fringed cones, or else by the flat always petioled leaves. The variety occurs in the cañons of the foothills of the San Bernardino Mountains, and in the San Felipe Cañon, at an elevation of 3,000 to 5,000 feet, with oaks and below most of the coniferous trees. It looks very distinct, but with the exception of the proportions of the cones and seeds no reliable specific characters can be discovered. Transition forms between the two have not yet been found.

9. TSUGA, Carrière. Hemlock Spruce.

Male flowers a subglobose cluster of stamens, from the axils of last year's leaves, the long stipe surrounded by numerous bud-scales; commissure of the anthers terminating in a short spur or knob; cells opening transversely by a continuous slit. Female aments terminal on last year's branchlets; bract somewhat shorter than the scale. Cones maturing in the first year, pendulous; scales and short enclosed bracts persistent on the axis. Seeds with resin-vesicles on the surface; wing at last breaking off. Cotyledons 3 to 5 or 6. — Large trees, with slender often drooping terminal branchlets; leaves flat or angled, appearing 2-ranked, with a single dorsal resin-duct, conspicuously petioled, articulated on a prominent and at length ligneous and persistent base. — Conif. 185. *Pinus,* Linn., in part. *Pinus,* sect. *Tsuga,* Endl.; Parlat. *Abies,* Michx., in part.

Of the 5 species of this genus, two belong to eastern Asia, one to eastern and two to western North America. Four of these species are so closely allied that they can be distinguished only with difficulty. The single species of our second section has somewhat aberrant characters.

* *Leaves flat, obtuse, stomatose only beneath: pollen-grains discoidal: cones small, an inch long or less.* — Eutsuga.

1. **T. Mertensiana,** Carr. A very large tree (100 to 200 feet high), with rather thick red-brown bark; ultimate branchlets very slender, roughish, and when young long-hairy: leaves linear, 4 to 9 lines long and about $\frac{3}{4}$ line wide, abruptly petioled, entire or usually minutely spinulose-serrate toward the rounded tip, shining above, when young with two white bands beneath: male flowers 2 or $2\frac{1}{2}$ lines in diameter, shorter than the stipe: cones oblong-cylindrical, pointed, slightly pubescent; bracts truncate; scales longer than wide: seeds 1 to $1\frac{1}{2}$ lines long, the wing twice as long or more, scarcely widened toward the base: cotyledons 3, sometimes 4.

— Conif. 2 ed. 250. *Pinus Mertensiana*, Bong. Veg. Sitch. 45; Parlat. *Abies Mertensiana*, Lindl. & Gord. *A. Albertiana*, Murr. *A. Brulgei*, Kell. Proc. Calif. Acad. ii. 8.

Peculiar to the Pacific Coast region, from Marin County (*G. R. Vasey*) and especially Mendocino (*Bolander, Kellogg*) to Alaska. Closely allied to the northeastern *T. Canadensis*, but a larger tree, with finer and straighter grained wood and redder bark, principally distinguished by the more elongated scales of the cone and the proportionately much longer and straighter wings of the seeds; in the eastern species the scales are almost as wide as they are long and the seeds larger, but the wings, very broad at base and almost triangular, are only ¼ or ⅓ longer than the seed. Another character taken from the leaf-structure, the presence of hypoderm cells on the edges, midrib and keel of the leaf, is not reliable, as these cells are occasionally found in leaves of *T. Canadensis*, though usually absent.

* * *Leaves mostly convex or keeled above, acutish, stomatose both sides: pollen-grains bilobed: cones larger.* — HESPEROPEUCE.

2. **T. Pattoniana.** A tall strictly pyramidal tree (100 to 150 feet high and 2 to rarely 4 feet through, in high altitudes only a shrub), of graceful habit, with slender pubescent branchlets and light green foliage: bark thick, much cracked and apt to scale off, reddish gray: leaves 6 to 12 lines long, angular, acutish, attenuate at base, often curved: male flowers about 2 lines wide, on a very slender stipe: cones cylindrical-oblong, 2 or 3 inches long: seeds 2½ lines in length, the wing not twice as long (about 4 lines), obliquely obovate, widest above. — *Abies Pattonii* or *Pattoniana*, Jeffrey. *A. Hookeriana*, Murray. *A. Williamsonii*, Newberry, Pacif. R. Rep. vi. 53, t. 7. *Pinus Pattoniana*, Parlat.

In the highest timber regions of the Sierra Nevada, at 8,000 to 10,000 feet altitude, from Ebbett's Pass at the head of the San Joaquin River northward, and through the Cascade Mountains, near Crescent City descending to near the coast (*Brewer*). At the timber-line its proportions are much stinted. Though differing in the shape of the leaves, the disposition of the stomata, and especially in the form of the pollen-grains, which resemble those of the true pines, yet I cannot separate this species from *Tsuga*, with which the single resin-duct of the leaves, the form of the male flowers, and the glands of the seed unite it.

10. PICEA, Link. SPRUCE.

Male flowers axillary or sometimes terminal on last year's branchlets, with an oblong or cylindrical staminеal column, its short stipe surrounded by numerous bud-scales; the commissure of the anthers expanding into a broad nearly circular erect crest; cells opening longitudinally: pollen-grains as in *Abies* (.045 to .060 line long). Female aments at the end of short or longer branchlets, the scales much larger than the bracts. Cones maturing in the first year, pendulous: scales and enclosed bracts persistent on the axis. Seeds without resin-vesicles, imbedded in the membranaceous base of the wing, which leaves their under side nearly free and permits them to drop out. Cotyledons 4 to 8. — Stately trees of pyramidal form and slower growth, with white soft close tough highly valued timber; leaves keeled above and beneath, more or less quadrangular or (in our species) flattened, articulated on a prominent at last ligneous and persistent rhombic base, spirally arranged all around the branchlets or (by a twist of the base) somewhat 2-ranked, the stomata usually more on the upper than on the lower surface, or, on the flat leaves, often only on the upper side (which is then apt to be turned downward); resin-ducts irregular, 1 or 2 lateral ones close to the epidermis of the lower side or none. — *Abies*, Tourn., in part; DC., in part; *Pinus*, Linn., in part. *Pinus*, sect. *Picea*, Endl.; Parlat. *Abies*, Don.

An important genus of about a dozen species, peculiar to mountainous and northern regions, of which 2 belong to Europe, 5 to Asia, and 5 to America; of the latter 2 are northeastern and 3 are western species.

1. **P. Sitchensis**, Carr. A tall strictly pyramidal tree (150 to 200 feet high and 6 to 9 feet in diameter), with thin scaly red-brown bark; branchlets thick and rigid, rough with the very prominent persistent leaf-bases, glabrous: leaves 5 to 8 lines long and a line wide or less, flattened, short-pointed (rarely obtuse or very acute), stomatose (and the young leaves white) only on the upper surface or very slightly so on the lower: cones cylindrical-oval, 1½ to 2½ or rarely 3 inches long, an inch thick or less, pale yellowish, the conspicuous lanceolate rigid bracts ½ or ⅓ the length of the oblong rounded denticulate scales: seeds slender, 1¼ to 1½ lines long, the wing 2½ to 3 times longer (4 to 4½ lines long by 1½ wide), narrowly oblong, only slightly oblique: cotyledons 4 to 6. — Conif. 260. *Pinus Sitchensis*, Bong. Veg. Sitch. 46. *Abies*, Lindl. & Gord. *Pinus Menziesii*, Dougl.; Lamb. Pin. 2 ed. t. 89. *Abies Menziesii*, Lindl. in Penny Cyc. i. 32; Loud. Arbor. iv. 2321, fig.; Nutt. Sylva, t. 116; Newberry, Pacif. R. Rep. vi. 56, t. 9.

Peculiar to the northern Pacific coast, mostly in wet sandy soil and near the mouths of streams, from Mendocino and Crescent City northward to Alaska; how far inland or how high above the ocean it may be found is at present unknown. This is probably the tallest spruce known, an excellent timber-tree, probably the best in Oregon, but too rare in California to be of much importance there. The older specific name, *Sitchensis*, must be substituted for the more generally used *Menziesii*, which represents absolutely the same species. The Rocky Mountain Spruce, which has heretofore been known under the same name of *Menziesii*, is *P. pungens*, Engelm., with more pungent and less flattened leaves, longer cylindrical cones, undulate retuse scales, and minute bracts, and with larger broadly winged seeds. — In Strawberry Valley and other valleys and slopes about Mount Shasta, at an elevation of 3,500 to 4,000 feet, a peculiar spruce occurs of which at present we know nothing but that its lower branches are very long, slender and pendulous, and the leaves much narrower than those of *P. Sitchensis*, 7 to 9 lines long and two thirds of a line wide, quite obtuse, strongly keeled and stomatose on the upper side and without stomata beneath; cones unknown. The name of *Picea pendula* suggests itself for this form, if indeed it should not prove to be a mountain variety of *P. Sitchensis*.

11. PINUS, Tourn.; Link. Pine.

Staminate flowers an oblong or cylindrical often much elongated stamineal column surrounded by a somewhat definite number (3 to 18) of calyx-like bud-scales, the outer ones lateral and strongly keeled, from the axils of scales and crowded into a capitate or spicate inflorescence around the base of the same spring's shoots: anther-cells opening longitudinally, the connective terminating in a mere knob or short dentate or usually larger semicircular erect crest: pollen-grains bilobed with 2 air-sacs, smaller than in *Abies* and *Picea* (.02 to .03 line long). Female aments also in the axils of bud-scales, higher up on the growing axis, either next to the terminal bud (subterminal) or on the side with leaves and sometimes other aments above them (lateral), solitary or several together; scales much larger than the bracts. Cones maturing in the second year, spreading or reflexed (very rarely erect), and subterminal (so called even in case of the elongation of the axis in the second year) or lateral; bracts thickened and corky and assisting in the formation of cells for the seeds under them; scales more or less thickened and corky, upon the free exposed surface (*apophysis*) bearing a terminal or dorsal unarmed or prickly protuberance (*umbo*). Seeds without resin-vesicles, usually surrounded by the rim-like base of the (sometimes very short) wing, which often spreads partly over the outer side of the seed. Cotyledons normally 5 to 15. — Trees of very various size and aspect, usually not as large as in the preceding genera, nor often of the same pyramidal growth; wood soft or hard, often very resinous, of surpassing importance for man's uses: primary leaves (only on seedlings and young shoots) flat, subulate and serrulate, the secondary in bundles of 1 to 5, from the axils of bud-scales and surrounded at base by a more

or less persistent sheath of membranous scales, needle-shaped, terete or semiterete or triangular according as the fascicles are of 1, 2, or more, mostly delicately serrulate, with stomata on all sides or rarely only on the upper inner sides; resin-ducts peripheral (close to the epidermis) or parenchymatous (within the cellular tissue) or internal (close to the cellular sheath surrounding the pith and vascular bundles), varying in number in the same species; strengthening cells (thick-walled longitudinal *hypoderm* cells) distributed under the epidermis, especially at the angles and keel, and often around the ducts, very rarely absent: seeds becoming detached from the wing at maturity, or rarely remaining adherent and at last breaking off. — *Pinus*, Linn., Endlicher, Parlatore, in part.

The largest and, geologically, the oldest coniferous genus, of 60 or 70 recent species, of which 24 belong to the Old World and nearly twice as many to the New. About 15 species are Mexican and West Indian, 11 belong to the Atlantic States, and 15 to the Rocky Mountains and the Pacific slope.

§ 1. *Apophysis generally thinner, with a terminal unarmed umbo: anthers terminating in a knob or a few teeth or in a short incomplete crest: leaves in fives, with peripheral ducts (in our species), their sheaths loose and deciduous: cones subterminal.* — STROBUS.

* *Wings longer than the seeds: leaves serrulate and (at least when young) denticulate at the blunt tip: female aments long-peduncled, erect: cones pendulous in the second year.*

1. **P. monticola**, Dougl. A tree 60 to 80 feet high and sometimes 3 feet in diameter, with smoothish pale bark splitting into square plates: leaves mostly 2 (occasionally 4) inches long, with 2 to 6 lines of stomata on the sides, rarely any on the back; teeth very small and distant: male flowers oval, surrounded by 8 involucral scales; anthers knobbed or short-crested: cones cylindrical, slender, 5 to 8 inches long, yellowish brown: seeds pale, 3 to 3½ inches long; wings twice as long, widest in the middle, pointed: cotyledons 6 to 9. — Lamb. Pin. 2 ed. iii. t. 67; Loud. Arbor. iv. 2291, fig.; Parlat. in DC. Prodr. xvi². 405.

On the higher Sierra Nevada, from 7,000 or 8,000 to 10,000 feet altitude, from the Calaveras and Mount Raymond northward; common in the Shasta region and on the Trinity Mountains, and extending to Oregon and Washington Territory. It is the western representative of the northeastern White Pine, from which it may be readily distinguished by the larger cones and stiffer and much less serrulate leaves, in which strengthening cells underlie almost the whole epidermis (but do not surround the ducts), while they are absent in the softer leaves of *P. Strobus*. The wood is said to be white and soft, as in the White Pine.

2. **P. Lambertiana**, Dougl. A tree of gigantic dimensions, 150 to 300 feet high and 10 to 20 feet in diameter, with light-brown smoothish bark splitting in small sections: leaves 3½ to 4 inches long, rigid, with 5 or 6 lines of stomata on each of the 3 sides: male flowers oval, half an inch long, with 10 to 15 involucral scales; anthers denticulate-crested: cones cylindrical, bright brown, 12 to 18 inches long and 3 or 4 inches wide, on peduncles 3 inches in length: seeds smooth, black, 6 lines long; wing not quite twice as long, widest below the middle, obtuse: cotyledons 13 to 15. — Linn. Trans. xv. 500; Lamb. l. c., t. 68, 69; Loud. Arbor. iv. 2288, fig.; Nutt. Sylva, iii. 122, t. 114; Newberry, Pacif. R. Rep. vi. 42, fig. 14; Parlat. l. c. 406.

Throughout the State and northward to the Columbia River, on both slopes of the Sierra Nevada, in a forest belt with *P. ponderosa* and *Abies concolor* at an elevation of 3,000 to 5,000 or sometimes 7,000 or 8,000 feet; in the Coast Ranges only on the highest points, from the Santa Lucia Mountains to Humboldt County. Leaves stouter than in its allies, with a layer of strengthening cells under the whole epidermis and around the ducts. The wood is like that of the White Pine and similarly used. The exudation from the partially burned tree loses its resinous qualities and acquires a sweetness similar to that of sugar or manna, for which it is sometimes used, whence the name of "Sugar Pine."

* * *Wings of the large seeds narrow: leaves entire or nearly so: cones subsessile, spreading or declined.*

3. **P. flexilis,** James. A tree about 60 feet high and 3 to 5 feet thick, with furrowed gray bark: leaves 1½ to 2 inches long, rarely more, with few rows of stomata on the sides and usually very few on the back: male flowers in a short spike, oval, 6 or 7 lines long, with 8 or 9 involucral scales; anthers tipped by a spur or sometimes an incomplete crest: cones oval to subcylindric, 3 to 5 inches long, light brown, with somewhat squarrose scales: seeds oval, compressed, 4 to 6 lines long, the inconspicuous wing less than a line wide, usually remaining attached to the scale: cotyledons 6 to 9. — Long's Exp. ii. 27 and 35; Nutt. l. c., t. 112 (very poor); Engelm. Trans. Acad. St. Louis, ii. 208, and Wheeler's Rep. vi. 257; Parlat. l. c. 403.

Var. **albicaulis.** A tree of 40 or 50 feet in height, on the highest elevations low and shrubby, with very pale bark: cones oval or subglobose, 1½ to 3 inches long and 1½ to 2¼ thick, purple-brown; scales much thicker and somewhat pointed. — *P. albicaulis,* Engelm. l. c. 209. *P. cembroides,* Newberry, l. c. 44, fig. 15. *P. Shasta,* Carr. Conif. 2 ed. 390.

The species has been found in California only on Mount Silliman (*Brewer*) with the variety, and on the Inyo Mountains (*Hoffman*), and thence eastward on the mountains of Nevada and Arizona to the Rocky Mountains, where it is common from New Mexico to Montana. The variety occurs on all the alpine peaks of the Sierra Nevada from Mono Pass to Mount Shasta and Scott Mountains, and northward to British Columbia, and also in Montana. More closely resembling *P. Cembra* of the Old World than our White Pines, but distinguished by the leaf-structure, which in *P. Cembra* shows parenchymatous ducts in the serrulate leaves. The peripheral ducts in our species are destitute of strengthening cells. *P. albicaulis* is probably only an alpine form, occupying a higher belt on the mountains, and marked by its short thick and thick-scaled cones. The large seeds are used for food by the Indians.

§ 2. *Apophysis with a mucronate or (very rarely) blunt protuberance on the back: anthers terminating in a semi-orbicular or almost orbicular crest, except in the first three species.* — PINASTER.

* *Resin-ducts peripheral: leaves with entire margins and loose deciduous sheaths.*

+ *Leaves* 1 *to* 5: *cones ovate-subglobose, with few very protuberant scales: seeds large, almost wingless.*

4. **P. monophylla,** Torr. & Frem. A small tree, 20 or 25 feet high, with irregularly spreading branches and pale fissured or flaky bark: leaves rigid, spiny-tipped, solitary and terete or rarely in pairs and semiterete, 1¼ to 2¼ (mostly 1½) inches long, the sheaths 4 or 5 lines long: male flowers oval, with 6 involucral bracts; anthers terminating in a knob or a few teeth: cones 1½ to 2½ inches long and nearly as thick: seeds oval, 6 to 10 lines long, thick-shelled, yellowish brown and mottled: cotyledons 7 to 10. — Fremont's Rep. 319, t. 4; Parlat. l. c. 378; Engelm. Wheeler's Rep. vi. 259. *P. Fremontiana,* Endl. Conif. 183, in part.

In the Coast Ranges only about Fort Tejon, and from the eastern slope of the Sierra Nevada through Nevada and Arizona to S. Utah, frequent in the mountains and often in the most arid localities; well known as the "Nut Pine," and the seeds invaluable to the Indians as an article of food. It was long considered probable that the terete leaf was in reality a connate pair, but the structure shows a single bundle of vessels and therefore a single leaf. The ducts, always peripheral, vary greatly in number, from 2 or 3 to 12 or 14.

5. **P. Parryana,** Engelm. A small tree, 20 or 30 feet high and 10 to 18 inches in diameter, with a round top: leaves 3 to 5 (mostly 4) in the sheath, 1¼ to 1½ inches long: male flowers oval, with 4 involucral bracts in the axil of broadly oval acute bracts: cones subglobose, 1½ to 2 inches thick, with strongly elevated knobs: seeds oval, 5 to 8 lines long, with a thin light-brown mottled shell: cotyledons 8. — Amer. Journ. Sci. 2 ser. xxxiv. 332, note; Parlat. l. c. 402. *P. Llaveana,* Torr. Bot. Mex. Bound. 208, t. 53.

Thus far found but once, by Dr. C. C. Parry, 40 miles southeast of San Diego, just across the boundary line, at an altitude of 2,000 or 3,000 feet. One of the four nut pines, and distinguished from the last principally by the number of leaves in a sheath.

+– +– *Leaves in fives: cones ovate to subcylindrical, with numerous scales: seeds small, winged.*

6. **P. Balfouriana,** Jeffrey. A medium-sized tree, seldom over 50 feet high and sometimes 5 feet in diameter, of regular pyramidal growth: bark red-brown, deeply fissured: leaves 1 to 1¼ inches long, rigid, curved, crowded and appressed to the stem and persistent for 10 or 15 years: male flowers oval, a half-inch long, with 4 involucral bracts; anthers with a short irregularly denticulate crest: cones pendulous from the slender branchlets, subcylindrical, 3½ to 4 or rarely 5 inches long, dark purple; apophyses thick, with short deciduous prickles: seeds pale, mottled, 3½ to 4 lines long; wing 6 to 10 lines long, widest about the middle: cotyledons 5. — Gordon, Pin. 217.

Var. **aristata.** Tree 50 to sometimes 100 feet high: anthers with scarcely a knob: cones ovate, with thinner scales, and with shorter recurved or slender awn-like prickles: seeds smaller, 3¼ lines long, the wings 3½ to 5 lines long: cotyledons 6 or 7. — *P. aristata,* Engelm. l. c. 331, and Trans. Acad. St. Louis, ii. 205, t. 5, 6; Parlat. l. c. 400.

Alpine, on mountains near Mount Shasta (*Jeffrey*); on the flanks of Scott Mountains, forming a dark green belt from 5,000 to 8,000 feet altitude between the lighter colored *P. monticola* below and *P. flexilis,* var. *albicaulis,* above it (*Lemmon*); on the head-waters of King and Kern Rivers (*Brewer, Stegman*), and on Mount Whitney, *Rothrock.* The variety, with recurved prickles, on the Inyo Mountains (*Stegman*) and thence sparsely scattered on the higher mountains through Nevada, Northern Arizona and Southern Utah; the form with awned scales in Colorado. Mr. Lemmon describes the bark as reddish brown; the Colorado form has reddish gray bark. The reddish wood is of extremely slow growth, hard and tough. Hypoderm cells surround the leaf and also the ducts, distinguishing the leaves from those of *P. flexilis.*

* * *Resin-ducts parenchymatous: leaves serrulate, with stomata upon all sides; sheaths persistent.*

+– *Cones subterminal.*

++ *Leaves in fives.*

7. **P. Torreyana,** Parry. A small tree, 20 or 30 feet high and 12 to 15 inches in diameter: leaves crowded at the ends of the thick branchlets in the axils of lanceolate strongly fringed bracts, very stout, 8 to 11 inches long; young sheaths 15 to 18 lines long, old ones 6 lines long: cones ovate, 4 to 4½ inches long by 3½ thick, patulous or deflexed on peduncles an inch long; umbo short and stout or sometimes elongated and inflexed: seeds oval, 8 to 10 lines long, twice as long as the wing, which encloses the seed with a thick rim: cotyledons 13 or 14. — Bot. Mex. Bound. 210, t. 58, 59. *P. lophosperma,* Lindl. in Gard. Chron. 1860, 46; Parlat. l. c. 391.

On the coast of Southern California, from San Diego to San Pedro, buffeted by the sea winds and generally crooked and much defaced. The leaves are perhaps the stoutest of any known pine; seeds large and edible.

++ ++ *Leaves in threes.*

8. **P. ponderosa,** Dougl. One of the largest pines known (200 to 300 feet high and 12 to 15 feet in diameter), with very thick red-brown bark, deeply furrowed and split in large plates: leaves on stout branchlets in the axils of strongly fringed somewhat persistent bracts, 5 to 9 or even 11 inches long; the thin sheaths at first 9 or 10 (later 3) lines long: male flowers cylindric, flexuous, 1½ to 2 inches long, crowded into a short head; involucre of 10 or 12 bracts; anthers with a large semicircular scarcely dentate crest: cones oval, 3 or 4 (rarely 5) inches long, 1½ to 2 inches thick, of a rich brown color, sessile or subsessile, spreading or slightly recurved, often 3 to 5 together; umbo high, with a stout straight or incurved prickle:

seeds dark brown, 4 lines long; wing 10 to 12 lines long, widest above the middle: cotyledons 6 to 9. — Loud. Arbor. iv. 2243; Newberry, l. c. 36, t. 4; Parlat. l. c. 395; Engelm. Wheeler's Rep. vi. 261. *P. Benthamiana*, Hartw. Journ. Hort. Soc. ii. 189. *P. Beardsleyi* and *Craigana*, Murr. Edinb. New Phil. Journ. i. 286.

Var. **Jeffreyi.** A tree 100 to 200 feet high, with a more rounded top, more finely cleft and darker bark, and paler leaves 4 to 9 inches long: male flowers 1¼ inches long: cones larger, 5 to 12 inches long, lighter brown, on short peduncles, fewer in a cluster, with thinner apophyses, and slender prickles hooked backward: seeds 4 to 7 lines long; wings 12 or 13 lines long: cotyledons 7 to 11. — *P. Jeffreyi*, Murr. l. c. xi. 224, t. 8, 9; Parlat. l. c. 393.

Var. **scopulorum.** A smaller tree (80 to 100 feet high): leaves 3 to 6 inches long, often in pairs: male flowers an inch long: cones smaller, 2 or 3 (rarely 4) inches long, grayish brown, with stout prickles: seeds 2½ to 3½ lines long, the wings 9 to 12 lines: cotyledons 6 to 9. — *P. ponderosa* of the Rocky Mountain floras.

The widest spread western pine; the original form in California and Oregon, at low and high altitudes and even in the plains, often associated with *P. Lambertiana* and *Abies concolor;* the var. *Jeffreyi* usually on mountains above 5,000 feet altitude, especially on the eastern slope of the Sierra Nevada, where it is apt to grow in the most arid localities, ranging into Oregon. The third form is found throughout the Rocky Mountains. A magnificent tree, known throughout the west as the "Yellow Pine," and vying with the Sugar Pine and Sequoias, with very thick bark (in large trees 3 or 4 inches thick) and unusually thick sap-wood, which shows 100 to 200 annual rings before it becomes heart-wood. The latter is yellow, heavy and very resinous. The var. *Jeffreyi* has often been considered distinct, but connecting forms are not rare; one of these is *P. deflexa*, Torr. Bot. Mex. Bound. 209, t. 56. The rows of stomata are often, but by no means always, more distant in var. *Jeffreyi* than in the typical form. The leaves persist about three years and are therefore always found brush-like at the end of the branchlets, except in young shoots. The parenchymatous ducts (2 or 3 or more) of all the forms are generally very small, and are always surrounded with some (often many) strengthening cells, which are also found within the sheath. *P. Jeffreyi* is one of several species (*P. Balfouriana*, *P. Murrayana*, *Abies Puttoniana*, etc.) which were collected by Mr. Jeffrey, and described by Prof. Balfour anonymously (with figures by Greville) in what is sometimes cited as the "Report of the Oregon Committee." The authority for the specific names is given variously by different authors; fortunately most of them may be referred to other species.

++ ++ ++ *Leaves in pairs.*

9. **P. contorta,** Dougl. A low tree, 5 to 15 or rarely 20 to 25 feet high and 6 inches in diameter, with a rounded or depressed top and thin smoothish bark: leaves 1 to 1½ inches long by half a line wide, strongly and closely serrulate; bracts scarcely fringed: male flowers cylindrical, ½ inch long, in a spike 1 or 2 inches in length; the outer pair of the 6 involucral bracts nearly as long as the inner ones; anthers with semicircular crests: cones clustered, oval or subcylindric, very oblique, with strong knobs and delicate prickles, or rarely almost without knobs, very often serotinous (remaining closed for several or many years): seeds black, grooved, 2 lines long; wings 6 lines long, widest above the base, tapering upward: cotyledons 5, rarely 4. — Loud. Arbor. ii. 2292, and Encyc. 975, fig. 915. *P. inops*, Bong. Veg. Sitch. 45; Hook. Fl. Bor.-Am. ii. 161. *P. Bolanderi*, Parlat. l. c. 379.

Var. **Murrayana.** Much taller and straighter, 80 to 120 feet high and 4 to 6 feet in diameter, with a conical head and thin scaly light grayish-brown bark: leaves 1 to 3 (mostly about 2) inches long, ¾ to 1 line wide, light green, delicately serrulate; sheaths 4 to 6 lines long, or old ones 1 to 1½: male flowers with 6 to 8 involucral bracts: cones very rarely lateral, less oblique, often opening at maturity and deciduous: wings of seeds longer. — *P. contorta*, Newberry, l. c. 34, t. 5, and of the Californian botanists; Parlat. l. c. 381, in part. *P. inops*, Benth. Pl. Hartw. 337. *P. Murrayana*, Murr. l. c. 226. *P. contorta*, var. *latifolia*, Engelm. in Bot. King Exp. 331, Porter's Fl. Colorado, 129, and Wheeler's Rep. vi. 262.

The original Douglasian *P. contorta*, which came from the mouth of the Columbia River, is a small narrow-leaved tree of the wet sandy coast of the Pacific from Mendocino to Alaska, a distance of perhaps 1,500 miles. Its narrow leaves, persistent and long-closed very oblique cones, which cover the tree so that sometimes scarcely any foliage remains visible, well characterize it.

The variety is a common tree on the higher Sierra Nevada to an altitude of 8,000 or 9,000 feet, extending into Oregon and in the Rocky Mountains southward to Colorado and Utah. In the Sierra Nevada the cones are more deciduous, but in Colorado they are as persistent as on the coast. Jeffrey's specimens on which *P. Murrayana* was based came from the high Sierras and are undoubtedly *P. contorta*, while *P. muricata*, with which they have been confounded, never occurs far from the sea and is otherwise very distinct.

P. MURICATA may be looked for here, as a form of it is found that seems to have sometimes terminal cones.

+– +– *Cones lateral.*

++ *Leaves in threes.*

10. **P. Sabiniana**, Dougl. An open-branched round-topped tree, with rough ash-gray bark, slender glaucous branchlets and sparse foliage: leaves drooping, slender, light-green or glaucous, 8 to 12 inches long and half a line wide, their sheaths an inch long, or later but half that length; bracts deciduous: male flowers oblong, about 10 lines long, in an elongated spike; involucral bracts 10 to 15, the exterior pair minute; crest of anthers semi-orbicular: female ament on a peduncle 1½ inches long: cone short-oval, acutish, massive, 6 to 10 inches long by 4 to 6 in diameter, deep mahogany-brown, persistent, with stout projecting apophyses and robust somewhat incurved points: seeds subcylindric, 9 to 12 lines long, dark; wing scarcely half as long, with broad rim: cotyledons 15 or 16. — Lamb. Pin. 1 ed. 146; Nutt. Sylva, iii. t. 113; Newberry, l. c. 39, fig. 13; Torr. Bot. Mex. Bound. t. 57.

Abundant, but scattered or in small groves, over the dry and hot hills of the Coast Ranges, in the Sacramento Valley, and on the foothills of the Sierra Nevada through the whole length of the State, not over 4,000 feet above the sea, and occasionally on their eastern slope (Owen's Valley, *Rothrock*). One of the "Nut Pines," and most important to the Indians, in appearance very different from all other pines.

11. **P. Coulteri**, Don. A tree 1 or 2 feet in diameter, with very thick rough and almost black bark: leaves crowded at the ends of the thick branchlets, stiff, erect, 6 or 8 to 10 or 11 inches long and ¾ line wide; young sheaths 1½ inches long, a half-inch when old; bracts much fringed: male flowers cylindric, 18 to 20 lines long, surrounded by 8 or 10 bracts, the outer half as long as the inner; anthers crested: cones shortly peduncled, long-oval, pointed, 10 to 14 inches long and 4 or 5 thick, yellowish-brown, persistent many years; scales with a broad elongated apophysis and a very stout long incurved point (sometimes 2 inches long): seeds oval, slightly ridged, black, 6 to 8 lines long; wing 10 to 15 lines long: cotyledons 11 to 14. — Linn. Trans. xvii. 440; Parlat. l. c. 392. *P. macrocarpa*, Lindl. Bot. Reg. xxvi. misc. 61.

In the Coast Ranges, at moderate elevations, from Monte Diablo to the southern border of the State. Wood brittle. Similar to the last species, but readily recognized by the thicker and stiffer branchlets and leaves. The cones are sometimes shorter and thicker than usual, with very short spurs, and may then be mistaken for those of *P. Sabiniana*, but the seeds and wings (or their impressions on the scales) will always distinguish them.

12. **P. insignis**, Dougl. A tree 80 to 100 feet high and 2 or 3 feet in diameter, with thick much-fissured bark: leaves 4 to 5 or rarely 6 inches long, slender (only half a line wide), very closely serrate, bright green, their bracts not fringed: male flowers oblong, half an inch long, in a spike 1 to 1½ inches in length, and surrounded by 10 involucral bracts; anthers small, crested: cones shortly peduncled, in clusters, deflexed, very obliquely short-oval, pointed, 3 to 5½ inches long and 2 or 3 thick, deep chestnut-brown, very persistent and often remaining closed for many years; scales on the outer side and especially toward the base enlarged, very thick and hemispherical, rarely flat, on the inner side flat and much smaller; all at last nearly unarmed: seeds grooved and tuberculated, black, 3 or 4 lines long; wing 8 to 10 lines long, widest above the middle: cotyledons 5 to 7. — Loud. Arbor. iv. 2243, fig. 2132–7; Torr. Bot. Mex. Bound. t. 55 (poor). *P. Californiana*, Lois. in Nouv. Duham. v. 243? *P. aduncа*, Bosc; Poir. in Lam. Dict. Suppl. iv. 418? *P. radiata*

and *P. tuberculata*, Don, Linn. Trans. xvii. 441 (also earlier names, but only based one on larger and the other on slenderer cones).

A tree peculiar to the sea-coast from Pescadero, south of San Francisco, to Monterey and San Simeon Bay, and known as the "Monterey Pine." Much interest attaches to the species, not only on account of its rapid growth and beautifully fresh green foliage, which make it ornamental in cultivation, but also because it is probably the old *P. Californiana*, which has never been identified but was said to have come from Monterey and to resemble in its cones the Mediterranean *P. Pinaster* and in its large seeds *P. Cembra*, such as we do not find near that town. *P. Sinclairii*, Hook. & Arn., Bot. Beech. 392, t. 93, is a factitious species founded upon a cone of *P. Montezumæ* (from Tepic) and the foliage of *P. insignis*, while *P. radiata* of the same authors, l. c. 392 and 443, is made up of the foliage of the former species and cone of the latter, as is proven by the specimens in Herb. Kew. A variety, *binata*, has been collected by Dr. Palmer on Guadalupe Island, with the normal cones of *P. insignis* but the leaves in pairs.

13. **P. tuberculata**, Gordon. A small tree, 3 to 20 or exceptionally 30 to 40 feet high, ½ to 1 foot in diameter, with a loosely branched conical top and thin light-brown roughish bark: leaves 3 or usually 4 to 7 inches long, ½ to ¾ line wide, slightly and distantly serrulate; sheaths at first 6 lines long; bracts slightly fringed: male flowers in an elongated spike, cylindrical, 7 to 9 lines long, with 6 involucral bracts, the outer not much shorter than the inner ones; anthers crested: cones in verticils of 2 to 4, several of which often form on the same year's shoot, pale leather-brown, at last silver-gray, persisting for many years often without opening, peduncled, strongly reflexed, 3 to 5 inches long by 1¾ to 2 inches thick, conic-cylindrical, pointed, very oblique at base; outer scales much enlarged conically, angular, the inner flat, all with sharp prickles: seeds black, grooved, 3 lines long; wing 7 or 8 lines long, widest at or above the middle: cotyledons 5 to 8. — Pin. 211; Parlat. l. c. 394. *P. Californica*, Hartw. Journ. Hort. Soc. ii. 189.

On the Coast Ranges from San Bernardino and the Santa Lucia Mountains to the Shasta region, and here and there on the foothills of the Sierra Nevada (Forest Hill, between the forks of the American River, at 2,500 feet altitude, *Bolander*). This Californian Scrub Pine is a small and unsightly tree or bush, which on the east side of Mount Shasta is found full of cones when only 2 or 3 feet high (*Brewer*). The name *P. tuberculata*, originally given to a form of the last species, was transferred to this after Jeffrey's discoveries in 1852, and having been so used invariably since should still be retained, inasmuch as Hartweg's name of *Californica*, though much older, was applied only through a mistaken identification of the species with Loiseleur's plant above mentioned, and must therefore be dropped.

++ ++ *Leaves in pairs.*

14. **P. muricata**, Don, l. c. A middle-sized tree, 25 to 50 or rarely 80 to 120 feet high, mostly slender (1 or 2 or rarely 3 feet thick), with reddish-brown roughish bark and a patulous top: leaves rigid, 4 to 6 inches long, ¾ to 1 line broad, strongly serrulate; bracts lightly fringed, subpersistent; sheaths 9 lines long, at length reduced to 1 line: male flowers oval, 6 to 8 lines long, in spikes an inch long; involucre half as long as the flowers, of 6 or 8 bracts, the outer as long as the inner: cones sessile, spreading or more or less recurved, in clusters of 4 to 7, often remaining closed and long-persistent, ovate and very oblique, chestnut-brown, 2 to 3½ (usually 3) inches long and 1½ to 2 inches thick; prickles short and stout or (in the southern form) making long straightish or incurved spurs on the outside: seeds 3 lines long, grooved and rough, black; wing 6 to 8 lines long, widest above the middle: cotyledons 4 or 5. — Torr. l. c., t. 54. *P. Edgariana*, Hartw. l. c. iii. 217.

Only near the coast, where it is exposed to the sea winds and fogs, to an altitude of 2,000 feet, from Mendocino, where it grows tallest (in peat-bogs), to Tomales Point (in the most sterile soil), Monterey and San Luis Obispo. In many respects similar to the last, but readily distinguished by the leaves being in pairs and by the short thick cones. The specimens collected at Tomales Point (*Brewer*, *Bolander*) have subterminal cones, but seem to differ in no other respect. The cones are said to persist over 30 years.

Class II. MONOCOTYLEDONOUS or ENDOGENOUS PLANTS.

Stems with the woody fibres scattered irregularly, not forming a separate zone of annual woody layers between the bark and pith. Embryo with one cotyledon. Leaves mostly parallel-veined, alternate, entire, and sheathing at base. Floral whorls usually in threes.

ORDER CIV. HYDROCHARIDACEÆ.

Aquatic herbs, with diœcious or polygamous flowers in membranous spathes; regular 6-parted perianth, in two series (calyx and corolla), more or less tubular at base; stamens 3 to 12; ovary inferior, 1 – several-celled, with ascending ovules on parietal placentæ; fruit indehiscent; and seed without albumen. — Distinguished from the *Naiadaceæ* and allied orders mainly by the inferior ovary. Perianth more or less tubular at base. Staminate flowers usually several and pedicelled: stamens distinct or united, the 2-celled anthers mostly introrse. Pistillate flowers usually solitary: style single: stigmas 3 to 6, more or less deeply bifid. Fruit submerged, a utricle or berry, usually many-seeded. Mostly perennials, with radical or in our species opposite or whorled leaves.

A widely distributed order, of a dozen genera and perhaps 30 species, very sparingly represented in North America, and especially so on the western coast.

1. ANACHARIS, Richard. Water-weed.

Flowers polygamo-diœcious, solitary and sessile in an axillary sessile tubular 2-cleft spathe. Perianth small, in the sterile flowers with 3 scarcely united greenish sepals and as many narrower petals; in the pistillate flowers with a greatly elongated filiform tube and a 6-parted spreading limb. Stamens 3 to 9, with short filaments united at base; anthers oval, or in the pistillate flowers oblong or wanting. Ovary 1-celled, with 3 parietal placentæ, few-ovuled. Style coherent with the perianth-tube: stigmas 3, bifid or emarginate. Fruit a subglobose utricle. — Slender perennials, with elongated leafy branching stems, and numerous opposite or whorled sessile thin 1-nerved leaves; two or three temperate or tropical species.

1. **A. Canadensis,** Planchon. Stems very slender and brittle, 1 to 4 feet long, terete, rooting at the nodes: leaves dark green and pellucid, in threes or fours, or the lower opposite, linear- or lanceolate-oblong, 3 to 6 lines long, acute, minutely serrulate, sessile: tube of the perianth in the pistillate flowers 2 to 8 inches long; limb 1½ to 2 lines in diameter, greenish-purple; sepals concave; petals recurved: stigmas long, terete, emarginate: utricle included within the small membranous spathe, nearly a line in diameter, 4 – 6-seeded. — Ann. & Mag. Nat. Hist. 2 ser. i. 86. *Elodea Canadensis,* Michx.; Caspary, Hydrill. 86 & 123. *Udora,* Nutt.

In Mendocino County (*Vasey*); Oregon (*Hall, Howell*); common in the Atlantic States, in ponds and slow streams, and naturalized extensively in Europe. The staminate flowers, which have rarely been noticed, are described as breaking from the stem and discharging their pollen upon the surface of the water, to which the pistillate are raised by the elongated perianth-tube.

Order CV. ORCHIDACEÆ.

Perennial herbs, with perfect irregular 3-merous flowers, an inferior 1-celled ovary with 3 parietal placentæ and very numerous ovules, 1 or 2 gynandrous stamens, and waxy or more or less coherent pollen. Flowers usually inverted by torsion of the ovary, the sepals and the two lateral petals similar, the superior petal (apparently inferior) dissimilar and called the *lip*. Stamens coherent with the style, forming the *column*, with usually only the anther opposite to the lower sepal perfect and two rudimentary lateral ones (in *Cypripedium* the lateral ones perfect and the third sterile); anthers 2-celled: pollen more or less coherent in 1 to 4 masses, rarely wholly granular. Stigma oblique and concave, mostly viscous, the upper margin often produced into an erect beak. Capsule coriaceous or membranaceous, dehiscing usually by 3 placentiferous valves, which separate from the persistent midveins of the carpels. Seeds very numerous and minute, scobiform (like sawdust), without albumen. Stems simple or scape-like; leaves alternate, sheathing, parallel-veined, sometimes scale-like. Roots often tuberous or thickened, sometimes parasitic.

A very large order, except *Gramineæ* the largest among Monocotyledons, occurring everywhere, and especially abundant in tropical America, though sparingly represented in the United States, and still more so on the Pacific coast.

Tribe I. MALAXIDEÆ. Anther one, terminal and resting like a lid upon the column, deciduous. Pollen-masses 4, smooth and waxy. — Our species without green herbage (a single green radical leaf in *Aplectrum* and *Calypso*). Flowers pedicellate.

1. **Calypso.** Scape 1-flowered, from a solid bulb. Lip saccate. Column broadly winged. Pollen-masses sessile on a large gland.
2. **Corallorhiza.** Flowers racemose, spurred or gibbous at base. Lip expanded or concave, bilamellate-crested. Column semiterete. Pollen-masses free, without glands. Roots branched, coralline.
3. **Aplectrum.** Flowers racemose, not spurred nor gibbous. Lip expanded, deeply 3-lobed, 3-lamellate. Column nearly terete. Pollen-masses in distinct pairs, without glands. Rootstock bearing annually a solid bulb and a single large green leaf.

Tribe II. OPHRYDEÆ. Anther one, connate with the column and persistent upon its face immediately above the stigma. Pollen-masses 2, of coarse grains united by an elastic web, each mass attached at base by a stalk to a viscid gland. Stems mostly leafy and flowers spicate or racemose.

4. **Habenaria.** Flowers numerous, white or greenish. Lip flat, spurred. Glands exposed.

Tribe III. NEOTTIEÆ. Anther one, erect and sessile or nearly so upon the top of the column and more or less covering and declinate upon the back of the stigma, persistent. Pollen-masses 2 or 4, of loosely cohering granules, becoming attached by their upper ends to a viscid gland on the beak of the stigma (or remaining free in *Cephalanthera*). Our species without spurs, mostly somewhat pubescent.

5. **Spiranthes.** Perianth oblique upon the ovary, the sepals and petals connivent: lip oblong, embracing the column, with 2 callosities at base. Flowers small, white or greenish, 1–3-ranked in a twisted spike. Stems leafy below, from tuberous-fascicled roots.
6. **Goodyera.** Like *Spiranthes*, but lip saccate, entire, without callosities and free from the column. Leaves all radical, white-reticulated.
7. **Listera.** Perianth spreading. Lip flat, 2-lobed. Stem low, from a fibrous root, with a pair of sessile leaves in the middle. Flowers small.
8. **Epipactis.** Perianth spreading and ovary recurved. Lip somewhat jointed in the middle, concave and auriculate at base, dilated above. Column short. Anther sessile behind the beaked stigma. Stem leafy, stout.
9. **Cephalanthera.** Flowers erect, the perianth more connivent. Column slender. Anther shortly stipitate and stigma beakless. Otherwise as *Epipactis*, but our species without green herbage.

TRIBE IV. CYPRIPEDIEÆ. Perfect anthers 2, lateral, the sterile one forming a dilated fleshy appendage above the terminal stigma. Pollen pulpy-granular.

10. **Cypripedium.** Perianth spreading. Lip an inflated sac. Stems leafy, the few flowers showy.

1. CALYPSO, Salisbury. CALYPSO.

Petals and sepals ascending, similar and nearly equal; lip saccate, with two short spurs below the apex. Column erect, broadly winged and petaloid, oval and concave, bearing the hemispherical anther on the summit. Pollen-masses in two pairs, the lower smaller, compressed, sessile upon a nearly square membranaceous gland. — A low herb, in bogs, the 1-flowered scaly-sheathed stem from a small solid bulb, and with a single radical broad thin leaf. Flowers showy.

A single species, very rare in Northern Europe and Siberia, rather more common in America.

1. **C. borealis,** Salisb. Stem 3 to 6 inches high, with two or three membranaceous brownish green sheaths, and a linear acuminate bract at the summit; the radical leaf broadly ovate or slightly cordate, an inch or two long, petioled: flower pedicelled, drooping: sepals and petals lanceolate, acuminate, light rose-color, 6 to 9 lines long; lip usually slightly longer, ovate-inflated, brownish-pink mottled with purple, the edge margined at the apex and bifid or entire, about equalling the tooth-like spurs and with a tuft of yellow hairs at base: column half the length of the petals: capsule oblong-cylindric, an inch long, about equalling the slender pedicel. — Parad. Lond. t. 89; Hook. Exot. Fl. t. 12, & Bot. Mag. t. 2763. *C. Americana,* R. Brown in Ait. f. Hort. Kew. v. 208.

In the mountains of Mendocino County, very rare (*Miller, Vasey*); more common in Oregon and Colorado, thence through British America and along the northern border of the Atlantic States.

2. CORALLORHIZA, Haller. CORAL-ROOT.

Flowers ascending. Petals and sepals ascending, the upper somewhat incurved, similar and nearly equal, but the lateral sepals oblique at base and either decurrent in a short spur adnate to the side of the ovary, or forming a projecting gibbosity above it; lip dilated and more or less recurved, flat or concave, with a pair of somewhat prominent longitudinal ridges near the base. Column semiterete and narrowly margined, broader at base, somewhat incurved, bearing the caducous anther on the summit. Pollen-masses in two pairs, distinct, sessile upon a short oblong gland. — Without green herbage and probably parasitical, the solitary scapes with 2 to 4 membranaceous sheaths, and bearing a simple raceme of brownish, yellowish or purple flowers: rootstocks much branched and coral-like: pedicels reflexed in fruit.

Of the following species one only is also found in Europe and Siberia. There is besides a species peculiar to the Atlantic States, two others are described from Mexico, and a third from Central Asia.

* *Spur present (sometimes obscure): flowers small, yellowish-green or whitish, often tinged or mottled with purple.*

†— *Spur more or less prominent: sepals and petals 3-nerved: capsule oblong-cylindric.*

1. **C. multiflora,** Nutt. Scape a foot or two high, many-flowered: sepals and petals 3 or 4 lines long; spur manifest, but wholly adnate to the ovary, a line long or more; lip broadly ovate and nearly sessile, somewhat convex and the ridges

prominent, 3-lobed by a deep cleft on each side, the lateral lobes usually narrow and acutish, the middle one rounded or emarginate, with undulate or denticulate margin : column stout, two thirds the length of the petals, the margins broader and somewhat thicker at base and approximate : capsule 6 to 9 lines long, narrowed to a short rather stout pedicel. — Journ. Acad. Philad. iii. 138, t. 7 ; Hook. Exot. Fl. iii, t. 174.

In the mountains, from San Diego to British Columbia, and eastward to the Atlantic. Flowers whitish, tinged and more or less veined or mottled with purple ; July to September.

2. **C. Mertensiana,** Bongard. Scape many-flowered, 8 to 15 inches high : sepals and petals linear-lanceolate, 3 or 4 lines long ; spur a line long, the lower half free from the ovary ; lip entire, broadly oblong, attenuate to the narrow base, thin and concave, the ridges only slightly prominent : column nearly equalling the petals, slender, the narrow margin scarcely broader or thicker below ; stigma projecting and cucullate : capsule 5 or 6 lines long or more, attenuate into the short slender pedicel. — Veg. Sitch. 165 ; Hook. Fl. Bor.-Am. ii. 194.

From Sitka to the Columbia and probably southward. Described by Bongard as with red flowers : the teeth at each side of the base of the lip, mentioned by him, do not seem to occur even in the specimens of his own collection.

+ + Spur very short or not at all prominent : sepals and petals 1*-nerved : capsule shorter, elliptic-oblong.*

C. INNATA, R. Brown. Scape slender, 4 to 10 inches high, 3–15-flowered ; upper sheath often expanded at the apex : sepals linear-lanceolate, acutish, 1½ to 2 lines long ; petals a little broader and obtuse ; lip broad-oblong, obtuse or emarginate, somewhat 3-lobed by a lateral cleft or indent, abruptly attenuate to the base, rather strongly crested : column a third shorter than the petals, stout, constricted in the middle : capsule 2 to 4 lines long, abruptly narrowed to a short very slender pedicel. — Washington Territory (*Lyall*), and perhaps southward ; in Colorado (*Parry*), eastward through Canada and the Atlantic States, and common northward to the arctic regions. Flowers in spring, often tipped with purple, the lip sometimes mottled.

** * Spur none, the lateral sepals oblique and with the base of the column strongly gibbous over the top of the ovary : lip entire, more or less concave, somewhat fleshy : flowers larger, purple and veined, not spotted.*

3. **C. Bigelovii,** Watson. Scape stout, 6 to 15 inches high : sepals and petals oblong, obtuse, about 4 lines long, twice longer than the column ; lip darker and strongly veined, fleshy, deeply concave, elliptical, broad and somewhat auriculate, with two thick laminæ : column rather slender, broadly margined below : capsule oblong-ovate, 6 to 9 lines long, briefly attenuate into a short pedicel. — Proc. Am. Acad. xii. 275. *C. striata,* Torrey, Pacif. R. Rep. iv. 152, t. 25, not Lindl.

In the Sierra Nevada and mountains of Northern California ; Big Tree Grove (*Brewer, Bolander*) ; Plumas County (*Mrs. Austin*) ; Marin County, *Bigelow.* In flower, June and July. Recognized by Dr. Torrey as distinct from *C. Macraei,* with which the *C. striata* of Lindley is to be identified. The figure cited fails to represent the peculiar gibbosity of the perianth.

4. **C. striata,** Lindl. Very similar to the last, but the flowers still larger, often 6 or 7 lines long : lip rather less fleshy, somewhat narrowed below, reflexed above the base and bearing the prominent laminæ upon the arch : scape stout, many-flowered, 1 to 2 feet high. — Orch. 534. *C. Macraei,* Gray, Manual, 510.

Plumas County (*Mrs. Austin*) ; a common species in Washington Territory and Oregon, ranging eastward to the Great Lakes.

3. APLECTRUM, Torrey. PUTTY-ROOT.

Perianth not at all gibbous or saccate at base : lip deeply 3-lobed, 3-ridged. Column nearly straight, not broader at base. Scape lateral from a thick globose solid bulb upon a slender horizontal rootstock, the bulb bearing at summit a single

large petioled plaited leaf. Flowers rather large, soon deflexed. — Otherwise as the last genus. A single species.

1. **A. hiemale,** Torr. Scape a foot high or more, with 3 or 4 greenish sheaths: the radical leaf ovate-oblong to broadly oblanceolate, 4 to 8 inches long, many-nerved, continuing through the winter: flowers 6 to 20 in a loose raceme, the ovary attenuate into a slender pedicel: perianth 6 lines long, narrow at base; sepals and petals linear-oblong, greenish-brown, 5-nerved; lip whitish or somewhat spotted, many-nerved, slightly shorter than the sepals, broadly obovate, attenuate into a distinct claw; the middle lobe undulate-margined: column nearly uniform in thickness, very narrowly margined. — Compend. 322, & Fl. N. Y. ii. 270, t. 127. *Cymbidium hiemale,* Willd.

Collected by Nuttall in Oregon and probably to be found in Northern California, though not otherwise known from west of the Rocky Mountains: eastward it ranges from the Saskatchewan to Arkansas and the Atlantic, in rich woodlands, not common. The bulbs are renewed each year and are persistent to the number of 4 or 5 upon the slender rootstock, 6 to 12 lines in diameter, their substance exceedingly glutinous. The capsule is described as ovoid-oblong, rather large.

4. HABENARIA, Willd.

Perianth ringent; sepals and petals nearly alike, convergent, or the lower sepals spreading. Lip flat and spreading, 3-lobed or entire, with a slender spur at base, without ridges or callosities. Column very short. Anther persistent upon the face of the column immediately above the stigma, the cells parallel or divergent at base. Pollen-masses one in each cell, of coarse grains united by an elastic web, each attached at base by a pedicel to an exposed viscid gland on the upper edge or at the side of the stigma. — Stems leafy or bracteate, often tall, from fleshy-fibrous or tuberous roots: flowers spicate or racemose, in our species not showy: capsules erect. — *Gymnadenia,* R. Brown, and *Platanthera,* Richard.

A large and widely dispersed genus; twenty or more species are found in the Atlantic States, several with handsome white, yellow or purple flowers and the lip often fringed. The following species all belong to the section *Platanthera,* having the anther-cells widely divergent at base and the glands distant.

* *Stem mostly slender, from an ovate or oblong tuber an inch long, bracteate, with 2 or 3 leaves at base: flowers small, greenish, the lip scarcely exceeding the uniform 1-nerved sepals.*

1. **H. elegans,** Bolander. Stem rather stout, a foot or two high: leaves lanceolate, acuminate, 4 to 8 inches long: spike usually dense, many-flowered; the subulate acuminate bracts a little shorter than the flowers: sepals and petals equal, 2 lines long, the former oblong, obtuse, the latter ligulate and fleshy, obscurely 3-nerved; the lip similar, with a filiform spur equalling or exceeding the ovary, 3 to 5 lines long: pollen-masses large, half a line long: beak of the stigma prominent, broad and rounded: capsule oblong, nearly sessile, 3 or 4 lines long. — Cat. Pl. St. Franc. 29. *Platanthera elegans,* Lindl. Orch. 285.

Near the coast, from Monterey (*Hartweg*) to Vancouver Island (*Lyall*), on hillsides, under oaks, pines, etc.

2. **H. Unalaschensis,** Watson. More slender, with an elongated and more open spike of smaller white or greenish flowers: leaves narrowly lanceolate to linear: bracts ovate, acutish, or rarely acuminate, not exceeding the ovary: sepals, petals and lip about a line long, the narrow or somewhat clavate spur scarcely or sometimes nearly twice longer: capsule oblong, sessile or nearly so, 3 lines long. — Proc. Am. Acad. xii. 277. *Spiranthes Unalaschcensis,* Spreng. Syst. iii. 708. *H.*

Schischmareffiana, Cham. in Linnæa, iii. 32. *Platanthera fœtida*, Geyer. *Gymnadenia longispica*, Durand, Journ. Acad. Philad. 2 ser. iii. 101. *H. fœtida*, Watson, Bot. King Exp. 341.

In the mountains from Mendocino County, and Yosemite Valley to Unalaska; also in the Wahsatch and Uintas, *Watson*. July and August.

* * *Stem stouter from a fusiform tuber, often tall, leafy throughout: sepals 3-nerved (except in H. Cooperi), the lateral oblique at base, the upper one broader: petals thin: lip fleshy, several-nerved.*

+ *Spur elongated, much exceeding the sepals.*

3. **H. leucostachys**, Watson. Stout, 1 to 4 feet high, bearing a many-flowered dense or open spike of rather large white flowers: leaves lanceolate, acute, diminishing upward: bracts linear-subulate, acuminate, equalling and usually exceeding the ovary: lateral sepals oblong, the upper ovate-oblong, 2 or 3 lines long; petals lanceolate and subfalcate, oblique at base, more or less connivent with the bases of the sepals; lip 3 or 4 lines long, rhombic-lanceolate; spur narrow, 4 to 6 lines long: beak of the stigma very prominent, ovate, more than half the length of the connective: glands linear-oblong, vertical: capsule oblong, sessile, 6 to 9 lines long. — *Platanthera leucostachys*, Lindl. Orch. 288. *H. dilatata*, Watson, Bot. King Exp. 340.

In moist places in the mountains, from Mariposa County to Oregon and Idaho; also eastward in Nevada and Arizona: July to September. Specimens collected by *Bolander* in swamps near San Francisco appear to be the same. Very similar to *H. dilatata*, Gray, of the Rocky Mountains and eastward, from which it is distinguished by its narrow elongated spur. It includes *H. Thurberi*, Gray, Proc. Am. Acad. vii. 389, excluding the variety, from which the characters were chiefly drawn and which is the following.

4. **H. sparsiflora**, Watson. Stem rather slender, a foot or two high: leaves narrowly lanceolate, acutish or acute: bracts linear-lanceolate, acuminate, usually much exceeding the greenish flowers, which are few (10 to 20) and distant: perianth thin and delicate, apparently spreading; lateral sepals oblong or lanceolate, 2 or 3 lines long, the upper ovate and a little shorter; lip narrow, linear or lanceolate, 3 or 4 lines long, nearly equalling the narrow spur: anther emarginate; stalks of the pollen-masses very slender: glands orbicular; beak of the stigma broadly triangular: capsule oblong, sessile, 6 lines long. — Proc. Am. Acad. xii. 276. *H. Thurberi*, var., Gray, l. c.

A species of peculiar habit, apparently common in the Sierra Nevada and in the mountains of Northern California.

5. **H. pedicellata**, Watson, l. c. Raceme loose, 20–30-flowered, with linear-lanceolate bracts shorter than the long-pedicellate flowers: sepals 2½ lines long, oblong, the upper ovate; lip oblong-lanceolate, half broader at base, 3 lines long; spur filiform, twice longer than the sepals: pollen-masses attached to the oblong glands by a short thick pedicel: beak of the stigma ovate-triangular, prominent: capsule ovate-oblong, 4 lines long, attenuate into a slender pedicel about as long.

A single specimen of this very distinct species was collected by *Brewer* in the Shasta Mountains (n. 1453, in part); September.

+ + *Spur short, scarcely exceeding the sepals.*

6. **H. hyperborea**, R. Brown. Stout, ½ to 2 feet high, with the habit of *H. leucostachys*: flowers greenish and smaller: lip lanceolate, scarcely broader at base, not connivent with the bases of the sepals; spur 2 or 3 lines long: glands orbicular: stigma not beaked.

Specimens apparently of this species, which ranges far northward and eastward and is also found in Europe, have been collected near Mono Lake (*Brewer*) and in Ruby Valley, Nevada, *Watson*.

7. **H. Cooperi**, Watson, l. c. Stout and tall (3 feet high): flowers numerous, spicate, yellowish-green: sepals and petals connivent at base, rather thick, equal, 2 lines long; lateral sepals oblong, the upper ovate; lip ovate, truncate at base, with a broad claw; spur short and thick: glands orbicular: beak of the stigma triangular: capsule oblong, sessile, 4 or 5 lines long.

The description is based upon a single specimen, collected on clay hills near San Diego by *Dr. Cooper*. Apparently very distinct.

8. **H. gracilis**, Watson, l. c. Very similar to *H. sparsiflora*, but rather taller and stouter (2 or 3 feet high) and the flowers more numerous in the loose elongated spike: lip linear, shorter, but exceeding the sepals; spur short and saccate, dilating downward. — *Platanthera gracilis*, Lindl. Orch. 288.

Oregon and Washington Territory (*Douglas, Lyall, Hall, Newberry*), and probably in Northern California. Distinguished especially by the saccate spur. *P. striata*, Lindl., would seem to be a form with the spur only half the length of the lip.

5. SPIRANTHES, Richard. Ladies' Tresses.

Perianth ringent, oblique on the ovary; the lateral sepals somewhat decurrent, the upper and the petals coherent; lip oblong, sessile or nearly so, the base embracing and adherent to the column, and with a callous protuberance on each side, the dilated summit spreading and undulate, usually entire. Column very short, oblique, terminating in a stout terete stipe bearing the ovate stigma on the face, and the beak above usually acuminate and at length bifid by the separation of the oblong viscid gland. Anther sessile or nearly so at the base of the stipe behind, mostly acuminate. Pollen-masses 2, thin and powdery, becoming attached above to the gland. — Flowers small, white or greenish, 1 – 3-ranked in a spirally twisted spike. Stems leafy, at least below, from fascicled-tuberous roots; leaves rather thin, mostly narrow and elongated, not petioled.

A genus of 50 or more species, widely distributed through both hemispheres. Our 10 or 12 species are exclusively American and chiefly confined to the eastern side of the continent.

1. **S. Romanzoffiana**, Cham. Glabrous, rather stout, 4 to 18 inches high, leafy, bracteate above: leaves oblong-lanceolate to linear: spike dense, 3-ranked, conspicuously bracteate, 1 to 4 inches long: perianth white, about 4 lines long, curved, the sepals and petals all connivent; lip recurved, ovate-oblong, contracted below the narrower rounded wavy-crenulate summit; callosities smooth, often obscure: the oblong-linear gland and very slender bifid beak three fourths of a line long: capsule oblong, 3 to 6 lines long. — Linnæa, iii. 32; Reichenb. f. Fl. Germ. xiii. 152, t. 477 (Orch. Eur. t. 125). *S. gemmipara*, Lindl.; Reichenb. f. l. c. t. 477, fig. 1 – 3.

In the high Sierra Nevada and northward, ranging across the continent; also "near the Presidio," *Bolander*. The callosities in western specimens are usually obscure.

2. **S. porrifolia**, Lindl. Very similar in habit, a foot high or more, but with a narrower spike and smaller flowers, the perianth 3 lines long: callosities at the base of the lip very prominent and nipple-like, pointing downward. — Orch. 467.

In the Coast Ranges (*Douglas*), and wet places, Sacramento Valley, *Hartweg*. The closely allied *S. cernua* of the Eastern States has the flower and especially the lip more recurved, and the prominent nipple-like callosities often hairy.

6. GOODYERA, R. Brown. Rattlesnake-Plantain.

Distinguished from *Spiranthes* by the saccate or ventricose lip, sessile, entire, and without callosities. — Scapes few-bracteate; leaves thickish, rosulate at the

base, petioled, usually white-reticulate. Rootstock creeping, with fibrous fleshy rootlets.

A dozen or more species are widely distributed around the globe, mostly in the tropics. The two other North American species, one of them common in N. Europe and Asia, are not found west of the Rocky Mountains.

1. **G. Menziesii,** Lindl. Scape and inflorescence pubescent, 6 to 15 inches high: leaves smooth, ovate-oblong to oblong-lanceolate, acute, 2 or 3 inches long, narrowed into a short petiole, usually somewhat reticulated with light greenish markings: spike many-flowered, rather dense, secund: bracts ovate-lanceolate, equalling the ovary: perianth white, puberulent, 2 to 4 lines long; lip strongly concave and erect, narrowing above into the slightly spreading summit: column short and straight: anther acuminate: gland and bifid beak very narrow and elongated (a line long or more): capsule ovate-oblong, very nearly sessile, 4 lines long. — Orch. 492. *Spiranthes decipiens,* Hook. Fl. Bor.-Am. ii. 203, t. 204.

In mountain woods from Mendocino and Mariposa Counties to the British Boundary, and eastward along the northern border to Western New York: August and September. Differing remarkably from the other species in the less saccate lip and in the acuminate instead of blunt anther, as well as in the elongated beak of the stigma, in these respects more nearly resembling a *Spiranthes.*

7. LISTERA, R. Brown. Twayblade.

Perianth spreading or reflexed: sepals and petals similar: lip free, longer than the sepals, flat and dilated, more or less deeply bifid. Column free and naked, bearing the ovate anther at the back of the summit. Pollen-masses 2, powdery, united to a very minute gland upon the rounded and entire beak of the stigma. — Stems low, from fibrous and creeping roots, and with a pair of broad sessile opposite leaves in the middle; flowers small and greenish, in a loose raceme.

A genus of 5 or 6 species belonging to the northern hemisphere, scarcely distinguished from *Neottia* but by its herbaceous foliage. Besides the following another species is found in the S. Atlantic States, the rest belonging to the Old World.

1. **L. convallarioides,** Nutt. Stem slender, 3 inches to a foot high, naked excepting one or two sheaths at base and the pair of orbicular or ovate acutish leaves (1 to 3 inches long) just below the raceme: inflorescence pubescent; flowers 6 to 20, purplish; bracts acute, shorter than the slender pedicels: sepals and petals linear, 2 or 3 lines long; lip oblong-ovate and cuneate, 2 to 5 lines long, emarginate or 2-lobed, with a small tooth on each side near the base: column slender, a line long: capsule erect, ovate-oblong, 3 lines long and about equalling the pedicel. — Hook. Fl. Bor.-Am. ii. 204, t. 205. *L. Eschscholtziana,* Cham. *Neottia Eschscholtziana,* Reichenb. f. Fl. Germ. xiii. 148, t. 478.

In the Sierra Nevada from the South Fork of the Joaquin (*Muir*) northward to Alaska, and across the continent; in damp cold woods.

L. CORDATA, R. Brown, collected in Oregon and Washington Territory (*Hall, Lyall*) and of like range north and eastward, should be found in California. The leaves are smaller, triangular-ovate and somewhat cordate; flowers minute, on short pedicels in a smooth raceme; sepals ovate; lip linear, 2-cleft, 2-toothed at base; column very short. Belonging also to Northern Europe.

8. EPIPACTIS, Haller.

Perianth spreading, the sepals and petals nearly equal: lip free, deeply concave at base, without callosities, narrowly constricted and somewhat jointed in the middle, the upper portion dilated and petaloid. Column short (equalling the anther), erect. Anther sessile behind the broad truncate stigma, on a slender jointed base, 2-celled, obtuse: pollen-masses coarsely granular, becoming attached above to the

gland capping the small rounded beak of the stigma. — Caulescent and leafy, from creeping rootstocks; flowers few and pedicelled, rather large in our species, with conspicuous bracts, divergent and the ovaries at right angles to the stem.

About a dozen species belong to Europe and Southern Asia, the only American representative being the following.

1. **E. gigantea,** Dougl. Stout and leafy, 1 to 4 feet high, nearly smooth: leaves from ovate below to narrowly lanceolate above, 3 to 8 inches long, acute or acuminate, somewhat scabrous on the veins beneath: raceme pubescent; flowers 3 to 10, greenish strongly veined with purple, with large foliaceous bracts, on slender pedicels 2 or 3 lines long: sepals ovate-lanceolate, 6 to 8 lines long, the upper concave; petals slightly smaller; lip as long, the saccate base with erect wing-like margins, strongly nerved and the nerves callous-tuberculate near the base, the dilated summit ovate-lanceolate, entire, somewhat wavy-crested: anther nearly 2 lines long: capsule oblong, 8 lines long, reflexed or spreading. — Hook. ii. 220, t. 202; Watson, Bot. King Exp. 341. *E. Americana,* Lindl. Orch. 462.

From Washington Territory to Santa Barbara, and eastward to S. Utah and Western Texas; on stream banks, flowering in June and July.

9. CEPHALANTHERA, Richard.

Flowers very similar to those of *Epipactis,* differing in the longer and more slender column, the stigma wholly beakless, and the anther shortly stipitate so as to be nearly or quite above the level of the top of the stigma; pollen-masses not connected nor attached to a gland; flowers erect, the perianth connivent or the lower sepals somewhat spreading. — Caulescent and leafy, with small bracts (our only species leafless and scarious-bracted); rootstocks creeping.

A genus of about half a dozen species, peculiar to Europe and Northern Asia. The S. American genus *Chlorœa,* to which the following species was first referred, has the stems leafy at base, with numerous dilated sheaths above and large conspicuous bracts; the flowers more open, narrowed and scarcely at all gibbous at base, the lip being unguiculate and expanded instead of saccate, mostly entire and with papillose-crested veins; column membranously margined; anthers acute — differing in these respects from *Cephalanthera.* The pollen-grains in both genera are unconnected, as in *Cypripedium,* not united by threes or fours as in all other genera. In its peculiar leafless and parasitic habit our species resembles the American *Bletia aphylla,* which in the same way differs from all its congeners.

1. **C. Oregana,** Reichenb. f. Parasitic, whole plant white, a foot or two high, with 3 to 5 somewhat dilated sheaths and usually a few free linear-lanceolate bracts above, an inch or two long; floral bracts very small: flowers few to many, sessile or nearly so: perianth about 6 lines long, gibbous at base; sepals and petals oblong-lanceolate, nearly equal; lip a little shorter, the saccate base with broad wing-like margins as in the last species, the nerves somewhat tuberculate-crested within; upper portion very broad and suborbicular, the nerves in the centre wavy-crested: column 2 lines long, about twice longer than the anther. — Linnæa, xli. 53. *Chlorœa Austinæ,* Gray, Proc. Am. Acad. xii. 83.

Northern California and Oregon: Shasta County, under firs (*Brewer*); Plumas County (*Mrs. Austin*); Mendocino County (*G. R. Vasey*); near Calto. in open forests, and at the Dalles, Oregon, "in water," *Kellogg & Harford.* First collected by *Nuttall* in Oregon. Flowers described by Professor Brewer as readily falling from the pedicels.

10. CYPRIPEDIUM, Linn. Lady's Slipper.

Sepals spreading, the lateral often united into one under the lip: petals similar, usually narrower: lip an inflated sac, with the incurved margin auricled near the

base. Column very short, incurved, bearing at each side a 2-celled anther on a short filament: stigma terminal, disk-like, broad and obscurely 3-lobed, covered above by the fleshy triangular and pedicelled sterile anther. Pollen pulpy-granular. — Stems herbaceous and leafy, from tufted fibrous roots; leaves large and many-nerved, plaited, sheathing at the base; flowers few or solitary, large and showy, pedicellate and leafy-bracted.

A genus of 25 or 30 species, a third belonging to Europe and Asia, the remainder to America from the Arctic Ocean to Peru — chiefly North American.

1. **C. montanum**, Dougl. More or less roughly and glandular-pubescent, stout, a foot or two high, leafy: leaves ovate to broadly lanceolate, acuminate, 4 to 6 inches long: flowers 1 to 3, shortly pedicelled: sepals and wavy-twisted petals brownish, narrowly to linear-lanceolate, 1½ to 2½ inches long, the lower sepals united nearly to the apex; lip oblong, an inch long, dull white veined with purple: sterile anther ovate-triangular to oblong-lanceolate, 4 or 5 lines long, on a slender filament, deeply channelled above, yellow with purple spots, somewhat longer than the stigma: capsule erect or nearly so, oblong, 10 lines long. — Lindl. Orch. 528. *C. occidentale*, Watson, Proc. Am. Acad. xi. 147.

Frequent in the mountains from Santa Cruz and Mariposa Counties to Washington Territory. Flowers very fragrant; June and July.

2. **C. Californicum**, Gray. Pubescent, leafy, a foot or two high: leaves ovate-lanceolate, acute, the upper lanceolate and acuminate, 3 or 4 inches long: flowers 3 to 6, shorter than the bracts: sepals broadly oval, the lower united to the apex, acute, half an inch long, equalling the oblong-linear acutish petals, all greenish-yellow; lip obovate-globose, white or light "rose-color and spotted," a little exceeding the sepals, pubescent within at the base: sterile anther rounded and arching, nearly sessile, 2 lines long, equalling the roughened stigma: capsules reflexed, oblong, 8 lines long. — Proc. Am. Acad. vii. 389.

In damp soils in open woods in the northern part of the State; on the Upper Sacramento in an upland swamp with *Darlingtonia* (*Brewer*); Red Mountains, Mendocino County, *Kellogg* & *Harford*. August and September.

Order CVI. IRIDACEÆ.

Perennial herbs, with equitant sheathing 2-ranked ensiform or linear leaves, and perfect triandrous regular flowers, the petal-like divisions of the superior 6-cleft perianth in 2 series and convolute in the bud; stamens on the base of the sepals, distinct or monadelphous and with extrorse anthers; ovary 3-celled, becoming a somewhat 3-lobed or triangular loculicidal capsule, with few to many anatropous seeds; embryo straight in usually fleshy albumen. — Flowers showy, few or solitary, spathaceously bracteate. Style usually 3-cleft at the apex, the stigmatiferous branches often petaloid-dilated. Stems commonly from creeping rootstocks or corms, which are more or less acrid.

A large order of 50 or more genera, chiefly S. African, S. American, and Mexican, sparingly tropical. The following are the only genera occurring in the United States, excepting *Nemastylis* in the S. Atlantic States and a few species of Mexican genera found in Texas and New Mexico.

1. **Iris.** Outer segments of the flower recurved, the inner erect. Branches of the style petaloid, opposite to the anthers. Filaments distinct. Rootstocks creeping. Seeds flattened.
2. **Sisyrinchium.** Segments similar, spreading. Stigmas filiform, alternate with the anthers. Filaments connate. Roots fibrous. Seeds globular.

1. IRIS, Tourn. FLOWER-DE-LUCE. FLAG.

Perianth-tube more or less prolonged above the ovary, the outer segments obovate above the narrow claw, spreading or recurved, the inner narrower and erect. Stamens distinct, with linear or oblong anthers, beneath the arching petal-like branches of the style. Base of the style connate with the perianth-tube; the divisions declinate on the sepals, stigmatic at the thin apex, above which is a broad 2-parted crest, this decurrent on the inner side to the base of the style forming a narrow covered channel. Ovules numerous, in 2 rows in each cell. Seeds horizontal, flattened or more or less turgid. — Stems rather stout, mostly terete, from usually thickened rootstocks: leaves ensiform or linear: flowers large and showy, solitary or few in a forked corymb: spathe of 2 or more valves, the inner scarious. — Baker, Revis. in Gardener's Chronicle, 1876, & Journ. Linn. Soc. xvi. 136.

A genus of nearly 100 species, distributed through the extra-tropical regions of the northern hemisphere, most abundant in Asia. Of the 16 or 18 species of the United States the following are mostly confined to the Pacific slope, and all belong to § *Apogon*, in which the divisions of the perianth are wholly without crest or beard.

* *Perianth-tube narrow and cylindrical, more or less elongated: stems leafy: leaves linear: bracts of the spathe closely approximate, foliaceous.*

1. **I. macrosiphon,** Torr. Stems low and very slender, 1 to 10 inches high, somewhat flattened, from slender rootstocks (a line or two in diameter): radical leaves often much elongated (6 to 15 inches long and a line or two wide), narrowly acuminate: bracts linear-lanceolate and usually long-acuminate, 2½ to 4 inches long and 3 or 4 lines broad: flowers 1 or 2, shortly pedicellate, with a filiform tube 1 to 3 inches long, bright lilac-purple; sepals 1½ to 2 inches long: capsule oblong-ovoid, shortly acute at each end, an inch long: seeds compressed, angled. — Pacif. R. Rep. iv. 144; Baker, Gard. Chron. 1876², 144.

Common in the Coast Ranges from San Francisco to Humboldt, on hillsides; blooming in March and April. The flowers are said to be sometimes cream-colored; well marked by the long tube and slender habit.

2. **I. Douglasiana,** Herbert. Stouter and usually taller than the last (6 to 18 inches high): radical leaves 3 to 5 lines wide, much exceeding the stem: bracts broader and less acuminate: flowers 2 or 3, somewhat larger and on longer pedicels (6 to 18 lines long), the narrow perianth-tube 6 to 12 lines long, pale lilac, the sepals with a white centre veined with purple: capsule oblong, acutely triangular, 1¾ inches long: seeds nearly globular. — Hook. & Arn. Bot. Beechey, 395; Hook. f. Bot. Mag. t. 6083; Baker, l. c. 226.

Apparently of the same range with the last.

* * *Perianth-tube short and funnelform above the ovary.*

† *Bracts foliaceous, separate and often distant: stems leafy: leaves narrowly linear: rootstocks slender.*

3. **I. Hartwegi,** Baker, l. c. 322. Stems slender and flattened, 2 to 9 inches high, from slender rootstocks, 2-flowered: leaves linear, 2 or 3 lines wide, long-acuminate, the lower exceeding the stem, often much elongated: bracts linear-lanceolate, rarely nearly contiguous, 2 or 3 inches long: pedicels ½ to 3 inches long: flowers "white, or pale blue with fine lines, becoming yellow"; tube thick, about 3 lines long; segments narrow and with long claws, 1½ to 2 inches long, the petals scarcely shorter: anthers equalling the filaments: styles with long crests: capsule oblong, 3-angled, acute at each end, an inch long: seeds flattened and angled.

Common in the Sierra Nevada from Mariposa to Plumas County; June.

I. TENAX, Dougl. (Bot. Reg. t. 1218; Hook. Bot. Mag. t. 3343; Baker, l. c. 323), ranging from Oregon to British Columbia, may perhaps be found in N. California. It is a similar species, but taller and 1-flowered; flowers larger, on short pedicels, bright lilac-purple, the segments 2 to 2½ inches long and broader: seeds scarcely flattened, somewhat angled obtusely.

+ + *Bracts contiguous or rarely separated: stems naked or nearly so, usually tall: rootstock stout.*

4. **I. longipetala,** Herbert. Stems stout, 1 to 1½ feet high, 3–5-flowered; leaves about as high, 3 to 5 lines broad: bracts foliaceous, large and acuminate, 3 or 4 inches long: flowers very large, bright lilac, on stout pedicels an inch or two long; tube funnelshaped, 3 lines long; sepals 2½ to 3 inches long and 1 to 1¼ broad, narrowed to a short claw, white below and veined with violet, the midvein yellow; petals oblanceolate, 2 inches long: anthers shorter than the stigmas: styles broadly crested: capsule oblong, narrowed at each end, 2 inches long: seeds flattened, nearly 3 lines long. — Hook & Arn. Bot. Beechey, 369; Hook. Bot. Mag. t. 5298; Baker, l. c. 615.

In meadows about San Francisco Bay and to Monterey; May.

5. **I. Missouriensis,** Nutt. Stem rather slender, terete, naked or with 1 or 2 leaves, ½ to 2 feet high, (1–3-) usually 2-flowered: leaves 2 or 3 lines broad, mostly shorter than the stem: bracts dilated and scarious, 1 to 1½ inches long, acute or acuminate: flowers pale blue, on pedicels ½ to nearly 2 inches long; tube 3 or 4 lines long, narrowed below; sepals 2 to 2½ inches long, the petals a little shorter, all with narrow claws: anthers not exceeding the filaments, equalling or exceeding the stigmas: capsule oblong, triangular or subterete, 1 to 1½ (rarely 2) inches long, acute at each end: seeds obovate, acute at base, 2 lines long. — Journ. Acad. Philad. vii. 58. *I. Tolmieana,* Herbert in Hook. & Arn. Bot. Beechey, 396; Watson, Bot. King Exp. 342; Baker, l. c. 226.

On the eastern side of the Sierra Nevada from Inyo to Siskiyou County (Yreka, *Greene*) and the Columbia, common in the mountains of the interior eastward to Colorado and Montana, and south to Arizona; apparently the only species of the Great Basin. What appears to be the same is also found near Fort Tejon, *Kennedy.* It was erroneously described by Nuttall, from dried specimens, as having the outer segments yellow. Very variable in size, but well marked by its scarious bracts; flowering June and July.

2. SISYRINCHIUM, Linn. BLUE-EYED GRASS.

Perianth 6-parted, the segments equal and similar, spreading. Stamens more or less monadelphous; anthers oblong or lanceolate. Style short: stigmas filiform and involute, alternate with the stamens. Capsule membranaceous, subglobose. Seeds several, rounded. — Stems simple or branched, usually geniculate and winged, from fibrous roots, with linear-lanceolate or grass-like radical leaves, and fugacious flowers on slender pedicels, clustered within 2 sheathing herbaceous bracts, with a scarious bractlet subtending each pedicel.

About 40 species, all American, mostly Mexican and South American (one species also found in the Bermudas and perhaps native to Europe). Three species or more are found in the Atlantic and Gulf States.

* *Filaments united to the top: anthers short-sagittate: stigmas short: flowers blue: stems ancipital, usually branched.*

1. **S. bellum,** Watson. Stems ½ to 2 feet high or more, smooth or scabrous on the margin, with a single or often 2 or 3 nodes: leaves a line or two wide, shorter than the stem: peduncles 1 to 4 (usually 2) at each node, 2 to 4 inches long and about equalling the bract: spathes of 2 mostly nearly equal bracts, a half to an inch long, scabrous on the keel, 4–7-flowered: flowers 6 to 12 lines broad, some-

what pubescent as also the ovary, light purple, darker below and yellow at base, the segments 3-toothed or mucronate, and shortly ciliate: stamens 3 lines long, the anthers very small: stigmas scarcely exserted: capsule depressed-globose or obovoid, 2 or 3 lines long: seeds two thirds of a line in diameter, obscurely pitted. — Proc. Am. Acad. xii. 277.

From San Diego to the Columbia River, in moist places; March to May. It resembles *S. anceps*, Linn., of the Atlantic States, which differs in its more slender habit, narrower leaves, smaller and usually glabrous flowers, and much smaller seeds. Sometimes it occurs with only a single terminal sessile spathe, in which form it resembles S. MUCRONATUM, Michx., also an Eastern species, but ranging westward to beyond the Rocky Mountains, collected in N. Nevada (*Watson*) and probably occurring in N. California. It is low and slender, always with a single sessile spathe, the long-acuminate lower bract usually exceeding the smaller flowers, the segments of the perianth setosely mucronate, and the capsule globose.

* * *Filaments united only at base; anthers linear-sagittate: scapes with a solitary sessile spathe.*

+ *Flowers yellow: style very deeply cleft: scape 2-edged.*

2. **S. Californicum,** Ait. f. Scape broadly winged, 6 to 15 inches high, much exceeding the broad leaves (2 or 3 lines wide): outer bracts 6 to 15 lines long, more or less unequal, the longer about equalling the pedicels: flowers 3 to 7, bright yellow; segments 4 to 6 lines long, 5 – 7-nerved, obtuse or acutish: anthers 1½ lines long, about equalling the filaments: style cleft below the middle, the linear branches as long as the anthers: capsule obovate-oblong, 4 lines long: seeds half a line in diameter. — Hort. Kew. iv. 135. *Marica Californica*, Ker, Bot. Mag. t. 983. *S. lineatum*, Torrey, Pacif. R. Rep. iv. 143. *S. flavidum*, Kellogg, Proc. Calif. Acad. ii. 50, f. 3. *S. convolutum*, Klatt, Linnæa, xxxiv. 735.

Common near the coast, in wet places, from San Diego to Oregon; Indian Valley, Plumas County, *Lemmon*. Another yellow species (*S. Arizonicum*, Rothrock) is found in the mountains of Arizona, with leafy branching stems and large truncate capsules.

+ + *Flowers large, purple: style cleft at the apex: scapes compressed but not margined.*

3. **S. grandiflorum,** Dougl. Scapes rather stout, 6 to 12 inches high, exceeding the long-sheathing leaves: spathe 1 – 4-flowered: bracts broad, very unequal, the larger usually much exceeding the broadly campanulate flowers: perianth-segments 6 to 10 lines long, dark reddish purple, rarely white: filaments broad at base, 3 to 6 lines long, much shorter than the style; anthers 2 lines long. — Lindl. Bot. Reg. xvi. t. 1364; Hook. Bot. Mag. t. 3509; Don in Sweet's Brit. Fl. Gard. 2 ser. t. 388. *S. Douglasii*, Dietrich.

A showy species of N. California, ranging to British Columbia, Idaho and N. Nevada; May.

ORDER CVII. AMARYLLIDACEÆ.

Ovary inferior; otherwise like *Liliaceæ* — differing from *Iridaceæ* in having six stamens and leaves not equitant; its typical representatives acaulescent herbs with tunicated bulbs. The only Californian genus is *Agave*, which with *Fourcroya* forms the tribe *Agaveæ*, remarkably distinguished from the rest of the order by the stouter often caulescent habit, the roots not bulbous, leaves thick and often spiny-toothed, involucrate sheath none, æstivation valvate, and the horizontal flattened black seeds with a filiform embryo as long as the albumen.

An order of 70 genera and nearly 500 species, of temperate and tropical regions, largely of the Cape of Good Hope and South America, very sparingly represented in the United States.

1. AGAVE, Linn. American Aloe.

Perianth tubular at base or campanulate, thick and fleshy and somewhat persistent, 6-cleft; the valvate divisions similar and nearly equal. Filaments more or less adnate to the tube, geniculately inflexed in the bud, at length exserted: anthers linear, versatile. Style tubular, stout, and elongated: stigma thickened. Capsule coriaceous, with numerous horizontal flattened black seeds. Embryo as long as the horny albumen. — With short stems or usually acaulescent from a thick fibrous-rooted crown; the clustered leaves thick and fleshy, spiny pointed and usually with spiny teeth; flowers numerous, on very short jointed bracteolate pedicels, spicate or paniculate upon a stout and tall bracteate woody scape. — Engelmann, Trans. St. Louis Acad. iii. 291; Baker, Gard. Chronicle, 1877.

An American genus of perhaps 100 species, chiefly Mexican, about a dozen being found in the dry region between the Colorado River and Texas, and a single species in the S. Atlantic States. The genus is divided into three sections according as the flowers are solitary at each bractlet and loosely spicate (no species west of New Mexico), in pairs at each axil and densely spicate (of which *A. Schottii*, Engelm., and *A. parviflora*, Torr., with filamentous leaves, are found in S. Arizona), or with the flowers clustered and paniculate at the ends of the branches of the scape, as in the following species and in all the typical *Agaves*.

* *Perianth-tube many times shorter than the lobes.*

1. **A. Newberryi**, Engelm. Acaulescent: leaves lance-linear, 7 to 10 inches long, narrowing from a base 9 lines wide, rigid and entire, the terminal spine brown and semiterete, grooved above: scape slender, 8 feet high: flowers in a long and loose narrow raceme-like panicle, with short (6 lines long) lanceolate bracts; the branchlets an inch or two long and 1 to 3 inches apart, 2–5-flowered: perianth and ovary about an inch long, the tube very short and campanulate; lobes oblong: stamens on the base of the tube, short; anthers 4 or 5 lines long. — Trans. St. Louis Acad. iii. 309. *Agave, n. sp.*, Torrey, Ives' Rep. 29.

Collected only at Peacock Spring in Northwestern Arizona (*Newberry*), in early flower (in March); fruit therefore unknown.

2. **A. deserti**, Engelm. l. c. 310. Acaulescent: leaves densely clustered, thick, deeply concave and very glaucous, ovate-lanceolate, 6 to 12 inches long and ½ to 2 wide, slightly contracted above the broad spiny-toothed base, attenuate above the middle into a long (1 or 2 inches) slender laterally compressed narrowly grooved spine; margin herbaceous below the middle, horny above, with strong hooked teeth: scape slender, 4 to 10 feet high, with distant herbaceous attenuate-lanceolate toothed bracts: branches of the panicle 2 or 3 inches long or less, the lower horizontal, the upper erect: flowers bright yellow, on very short fascicled pedicels: perianth nearly an inch long, a little longer than the ovary, with a very short funnelform tube and oblong lobes: stamens on the throat, twice longer than the lobes; anthers 9 lines long: capsule oblong, shortly pointed, 1¾ inches long: seeds 2½ lines broad.

At the eastern base of the Coast Ranges in San Diego County, and on the adjoining desert; first discovered by Lieut. W. H. Emory in 1846.

* * *Perianth-tube not greatly shorter than the lobes: stamens inserted on its middle.*

3. **A. Shawii**, Engelm. l. c. 314, t. 2–4. Nearly acaulescent, the short trunk (8 to 12 inches long) covered with deep green ovate leaves 8 to 10 inches long and 3½ to 4½ wide, slightly contracted above the dilated scarcely denticulate base and acuminate with a stout broadly channelled spine; margin brown and horny, with very large close-set flat variously curved or straight spiny teeth: scape

stout, 8 to 12 feet high, nearly covered with large triangular foliaceous bracts (4 or 5 inches long), scariously margined: branches of the broad oval panicle very stout, horizontal or the upper ascending, 4 to 9 inches long, each with a terminal compact cluster of 30 to 50 nearly sessile flowers involucrate with large foliaceous bracts: flowers greenish yellow, 3 to 3½ inches long, the ovary a little shorter than the perianth; tube broadly funnelform, nearly half shorter than the suberect linear-oblong lobes: stamens slightly exserted, shorter than the at last elongated style: anthers 14 lines long: capsule acute, 2½ inches long and nearly an inch broad: seeds 4 lines wide.

On dry hills overlooking the Pacific near the Boundary Monument in the southwestern corner of San Diego County. One of the most striking and beautiful species of the genus, named in honor of Henry Shaw of St. Louis, as the founder and donor to that city of the "Missouri Botanic Gardens." Now introduced into cultivation; a detailed account of the flowers and flowering is given by Dr. Engelmann in Trans. Acad. St. Louis, iii. 537, t. 4.

Order CVIII. LILIACEÆ.

Terrestrial plants, mostly herbaceous, with perfect flowers, a regular corolla-like 6-cleft or divided perianth (the 3 outer segments rarely dissimilar and more or less foliaceous), stamens opposite the segments, with 2-celled anthers (or confluently 1-celled), and a superior 3-celled ovary becoming a few – many-seeded 3-celled capsule or berry; seeds anatropous or amphitropous, with small embryo surrounded by copious albumen. — Stems chiefly from tunicated or scaly bulbs, or corms, or more or less thickened rhizomes. Leaves sometimes net-veined. Flowers not spathaceous except in a few umbelliferous genera, dimerous in *Maianthemum*, diœcious or polygamous in *Nolina* and in some Melanthaceous genera. The stamens are only 3 (and ovary 1-celled) in *Scoliopus*, occasionally 3 with alternating staminodia in a few other genera. — Watson, Proc. Amer. Acad. xiv. 213.

A very large and important order, distributed all over the globe, excepting the polar regions, as now generally defined including about 180 genera and 1900 species, of which 50 genera and 235 species are North American. Many are remarkable for the beauty and fragrance of their flowers and have always been favorites in cultivation, as the Lily, Tulip, Hyacinth, Lily of the Valley, etc. Some others are cultivated for food, as Asparagus and various species of Allium; and many are valuable in medicine, among them the Squill (*Scilla*), Colchicum, Aloe, and Hellebore (*Veratrum*). The order forms a marked feature in the flora of California, and several of the genera are either peculiar to the State or to the western coast of the continent.

I. Flowers with scarious bracts, a persistent perianth with 1 – several-nerved segments, perigynous stamens with introrse anthers, and an undivided and mostly persistent style. Leaves with numerous longitudinal nerves and transverse veinlets. Pedicels often jointed.

* Inflorescence umbellate upon a naked scape from a bulb or corm: fruit a loculicidal capsule: seeds more or less turgid, with close black testa.

\+ Bracts broad and spathaceous: bulb mostly tunicated: taste and odor alliaceous.

1. **Allium.** Perianth deeply parted; segments 1-nerved. Filaments naked, in 1 row. Ovary globose-obovate, 3-lobed. Style filiform, jointed upon the very short axis. Seeds 1 or 2 in each cell. Pedicels not jointed.

\+ \+ Bracts several, distinct: corm coated, not alliaceous: capsule scarcely lobed, beaked, several-seeded.

\+\+ Perianth 6-parted; segments spreading, closely 2 – 3-nerved: stamens in 1 row: capsule subglobose, subsessile.

2. **Muilla.** Flowers greenish white. Filaments filiform, naked, adnate at base. Pedicels not jointed.

3. **Bloomeria.** Flowers yellow, on jointed pedicels. Filaments elongated, free, surrounded at base by a cup-shaped winged appendage.

++ ++ Perianth-segments more or less united, with the stamens on the throat, 1-nerved : pedicels jointed, except in n. 7.

4. **Brodiæa.** Perianth funnel-form, not contracted at the throat nor saccate at base, purple to white or yellow. Stamens 6, in 1 or 2 rows, with winged or naked filaments, or 3 and alternate with as many staminodia.
5. **Stropholirion.** Perianth pinkish, with short broadly turbinate 6-saccate tube, contracted at the throat; lobes spreading. Stamens 3, with alternate ligulate staminodia; filaments winged.
6. **Brevoortia.** Perianth deep scarlet with short yellowish lobes, the broad tube 6-saccate at base. Stamens 3, with alternate broad truncate staminodia.
7. **Androstephium.** Perianth pale lilac, the cylindric-turbinate tube about equalling the lobes. Stamens 6, in 1 row, the filaments united into an erect toothed tubular crown.

* * Flowers on subterranean pedicels, in a sessile umbel, with long linear scarious bracts, upon a short rootstock : capsule and seeds as in *.

8. **Leucocrinum.** Perianth white, salverform, with very narrow tube and several-nerved segments. Stamens 6, in one row. Leaves linear, elongated, flat.

* * * Inflorescence racemose or paniculate : root a bulb or corm : fruit a loculicidal capsule.

+ Flowers rather large, on jointed pedicels, in a simple open raceme : segments several-nerved : capsule obovate or oblong : seeds black, several in each cell : bulb tunicated.

9. **Camassia.** Scape naked. Flowers blue (rarely white); segments distinct, spreading. Seeds several, ovate, angled.
10. **Hesperocallis.** Stem leafy. Flowers white, funnelform, 6-cleft to below the middle. Seeds numerous, flat and horizontal.

+ + Flowers smaller, racemose-paniculate : capsule triangular-obovate ; cells 1 – 2-seeded.

++ Stems sparingly leafy, from tunicated bulbs : perianth-segments distinct, 3-nerved.

11. **Hastingsia.** Flowers white or greenish, numerous; perianth lax, scarious, the segments apparently 1-nerved, exceeding the pedicel. Style short.
12. **Chlorogalum.** Flowers white or pinkish, scattered; perianth at length twisted over the ovary, the segments distinctly 3-nerved. Style long.

++ ++ Stem leafy at base, from a coated corm : perianth salverform, deciduous, with 5-nerved segments.

13. **Odontostomum.** Flowers yellowish, scattered. Stamens very short, alternating with small linear coronal-lobes; anthers subglobose, dehiscent at the apex. Style deciduous. Seeds dark brown.

* * * * Inflorescence racemose or paniculate, the pedicels jointed : stem leafy, from a fibrous-rooted caudex or rootstock : fruit a berry, or dry and regularly or irregularly dehiscent.

+ Flowers small; segments distinct, 1-nerved : seeds 1 or 2 in each cell, subglobose, light-colored.

++ Fruit a berry : stem slender, from a creeping rootstock : leaves cordate to lanceolate : flowers in a small terminal raceme or panicle.

14. **Smilacina.** Stem leafy. Flowers trimerous, paniculate or racemose, solitary. Filaments subulate. Leaves sessile.
15. **Maianthemum.** Stem low, 2 – 3-leaved. Flowers dimerous, solitary or fascicled, in a simple raceme. Filaments filiform. Leaves mostly petiolate.

++ ++ Fruit thin-membranous and bursting irregularly, deeply 3-lobed : stem stout, leafy, from a thick woody caudex or rootstock : leaves numerous, linear-elongated, rigid, serrulate.

16. **Nolina.** Flowers polygamo-diœcious, in a loosely racemose simple or compound panicle. Naked caudex dilated at base and bearing a dense crown of leaves.

+ + Flowers large, with distinct several-nerved segments, racemose-paniculate on a stout leafy-bracteate stem from a stout caudex or rootstock : seeds many, horizontally flattened, black.

17. **Yucca.** Fruit baccate or capsular. Leaves linear-lanceolate, thick, rigid and spine-tipped.

II. Floral bracts none or foliaceous. Flowers with distinct mostly net-veined and deciduous segments, hypogynous stamens with more or less extrorse anthers, and usually deciduous styles united at least at base. Leaves mostly with anastomosing veinlets. Pedicels not jointed. Seeds brownish. (*Calochortus* and *Trillium* exceptional.)

* Flowers showy, terminal or axillary or subumbellate, upon a more or less leafy stem from a bulb or corm; segments bearing a nectary or gland : capsule many-seeded, mostly loculicidal.

+ Perianth-segments similar, naked : style long.

++ Bulb scaly: stem simple, strict, leafy and leafy-bracteate: anthers versatile: seeds flat, horizontal.

18. **Lilium.** Segments oblanceolate, with a linear nectariferous groove, usually spotted. Style undivided. Bulb-scales lanceolate.

19. **Fritillaria.** Segments broader, concave, often mottled; nectary a shallow pit. Styles united or distinct to the middle. Bulb-scales short, very thick.

++ ++ Stem low, lax, 2-leaved, from an oblong corm: anthers basifixed: seeds turgid.

20. **Erythronium.** Segments oblanceolate, callous-toothed each side of the grooved nectary.

+ + Outer perianth-segments smaller, somewhat sepal-like; the inner broad and usually bearded: stigmas sessile.

21. **Calochortus.** Stem usually lax or flexuous, from a coated corm. Anthers basifixed. Capsule usually septicidal.

Lloydia serotina, Reichenb., a widely distributed arctic and alpine plant, not yet discovered in California, has slender tunicated rhizomatous bulbs, grass-like leaves, low slender sparingly leafy stems, and a small solitary flower with spreading persistent 3-nerved segments (white, veined with purple), minute basifixed anthers, an entire persistent style, and an obovate capsule with flat seeds. It has been found in the Clover Mountains, Nevada, and in Colorado.

* * Flowers terminal or apparently axillary, solitary or subumbellate, without bracts, the leafy branching stems (scape-like peduncle in *Clintonia*) from a rootstock; segments oblanceolate, with a nectariferous groove. Fruit a berry. Leaves broad.

22. **Streptopus.** Flowers apparently axillary, mostly solitary on a geniculate pedicel. Filaments broad, very short. Anthers apiculate. Seeds striate. Leaves with transverse veinlets.

23. **Prosartes.** Flowers terminal, solitary or fascicled. Filaments slender. Anthers obtuse. Seeds smooth. Leaves net-veined.

24. **Clintonia.** Flowers solitary or umbellate. Filaments slender, pubescent. Ovary 2-celled. Seed smooth, crustaceous. Leaves few, ciliate, with transverse veinlets.

* * * Flowers terminal, solitary or in a sessile umbel, subtended by two or three broad leaves upon an otherwise naked stem from a stout rootstock. Perianth-segments unlike. Stigmas sessile, persistent.

25. **Scoliopus.** Flowers umbellate, upon a very short stem; outer segments lanceolate, the inner linear, deciduous. Stamens 3. Capsule 1-celled, with 3 parietal placentæ. Leaves a pair.

26. **Trillium.** Flowers solitary; segments persistent, the outer foliaceous. Anthers introrse. Fruit fleshy. Leaves 3, in a whorl.

III. Flowers in a simple raceme or panicle, with distinct persistent several-nerved segments, subhypogynous stamens with small anthers, and distinct persistent styles or stigmas. Bracts greenish or sometimes scarious. Leaves with transverse veinlets. Pedicels not jointed. Capsule deeply 3-lobed.

* Flowers usually polygamous. Anthers 1-celled, peltate on opening. Stems leafy. Leaves not rigid nor equitant.

27. **Veratrum.** Stem tall and stout, from a thick rootstock. Inflorescence paniculate, pubescent. Leaves broad, strongly nerved and plicate.

28. **Zygadenus.** Stem from a coated bulb. Inflorescence a raceme or subpaniculate, glabrous; flowers erect, the segments glandular at base. Leaves linear.

Stenanthium is distinguished from *Zygadenus* by its nodding flowers and narrow acuminate glandless perianth-segments. S. occidentale, Gray, with a loose usually simple raceme of yellowish-purple flowers (6 to 9 lines long), is found in northern Oregon and in Washington Territory, on streambanks in the mountains.

* * Flowers perfect on bracteolate pedicels in a simple raceme on an equitant-leafy stem from a creeping rootstock. Anthers 2-celled, introrse. Seeds numerous.

29. **Tofieldia.** Flowers involucrate with 3 scarious united bractlets. Filaments naked. Styles short. Capsule ovate, 3-beaked. Seeds horizontal, not caudate.

30. **Narthecium.** Bractlet linear. Filaments woolly. Style none. Capsule oblong, attenuate upward. Seeds ascending, caudate at each end.

* * * Flowers perfect on naked pedicels in a simple dense raceme upon a very leafy stem from a thick rootstock. Styles reflexed. Leaves very narrow, rigid and rough-edged.

31. **Xerophyllum.** Flowers white, on long pedicels; segments 5 – 7-nerved. Seeds few, not appendaged.

1. ALLIUM, Linn. Onion.

Perianth of 6 nearly equal and distinct segments, lanceolate to linear, usually somewhat spreading, 1-nerved, mostly white or rose-colored, often gibbous at base, persistent. Stamens 6, on the base of the segments; filaments naked, filiform with a more or less dilated deltoid base; anthers ovate-oblong, versatile. Ovary sessile, subglobose, deeply 3-lobed, with a very short axis: ovules 2 at the base of each cell (rarely 1 or several), ascending; style filiform, persistent, the lower part nearly free between the cells and jointed on the axis; stigma rarely thickened or 3-lobed. Capsule obtusely 3-lobed, obovate-globose, often crested, loculicidally dehiscent. Seeds obovoid and wrinkled, with thin dull black testa. — Scape from a tunicated sometimes rhizomatous bulb, very rarely from a coated corm, bearing an umbel subtended by a 2-valved (rarely 3 – 5-valved) spathe; pedicels not jointed; odor and taste strongly alliaceous.

One of the largest genera of the order, numbering about 250 species, and confined almost exclusively to the northern temperate zone; only 2 or 3 are South American and as many Mexican. Several of the Old World species have been largely cultivated from very early times, as the Onion (*A. Cepa*), Garlic (*A. sativum*), Leek (*A. Porrum*), Schallott (*A. Ascalonicum*), and Chives (*A. Schænoprasum*); the latter species is also indigenous to America, from the Great Lakes to Washington Territory and northward. Many of the Californian species are peculiar either in their more or less solid bulb, in the markings of the bulb-coats, in their ancipital scapes, or in other characters. Most of the groups are readily recognized by a peculiar habit. The reticulation of the bulb-coats, when it occurs, is in some species recognizable by the naked eye or with a simple lens, but in others needs a glass of moderate power for its clear definition; the markings are usually confined to a few among the outer coats.

Scape stout, tall, terete, from an ovate coated corm and propagating by a lateral bulb-bearing offshoot: leaves 2 or more, linear.
  Bracts acuminate: flowers large, on long pedicels: stamens included: capsule not crested. 1. A. UNIFOLIUM.
Scape compressed, from an oblong coated bulb crowning a rhizome. leaves several, linear: bracts short, united: flowers small, on short pedicels.
  Stout: bracts 2 to 4: flowers numerous: segments narrowly acuminate: stamens exserted: capsule not crested: bulb white. 2. A. VALIDUM.
  Slender: bracts 2: perianth-segments acute: stamens included: capsule shortly crested: bulb deep red. 3. A. HÆMATOCHITON.
Scape terete, slender: bulb small, ovate, not rhizomatous: leaves narrowly linear: stamens included, except in n. 6.
  Leaves 2 or more, sheathing: scape 4 to 10 inches high or more.
    Ovary obscurely crested: perianth-segments serrulate, rose-colored.
      Reticulation prominent, quadrate: flowers deep rose-color, the segments with acuminate recurved tips. 4. A. ACUMINATUM.
      Reticulation more obscure, undulate-serrate: segments narrowly acuminate: filaments filiform. 5. A. BOLANDERI.
    Ovary 6-crested: segments entire.
      Scapes usually rather tall: flowers numerous, white or light-pink, the perianth becoming thin and lax.
        Bracts 4: segments oblong-lanceolate: stamens exserted. 6. A. SANBORNI.
        Bracts 2: segments ovate-lanceolate: stamens included. 7. A. ATTENUIFOLIUM.
      Scapes low: perianth rose-colored, becoming rather rigid.
        Filaments deltoid at base.
          Reticulation evident, transversely zigzag: segments ovate-lanceolate: crests narrow, central. 8. A. SERRATUM.
          Reticulation indistinct: segments oblong-lanceolate, acuminate: crests conspicuous. 9. A. BISCEPTRUM.
          Reticulation distinctly quadrate: segments oblong-lanceolate, acuminate: crests obscure. 10. A. LACUNOSUM.

Filaments filiform : crests conspicuous.
Segments broadly ovate-lanceolate. 11. A. CAMPANULATUM.
Flowers small ; segments narrowly-lanceolate. 12. A. BIDWELLIÆ.
Leaf solitary, narrowly linear or filiform : capsule prominently 6-crested : scape low.
Scape very slender : leaf revolute-filiform : stigma 3-cleft : perianth much exceeding the stamens. S. California.
Perianth rose-colored, 3 or 4 lines long : crests emarginate or erose. 13. A. PARRYI.
Perianth deep rose-color, 5 lines long : crests fimbriate. 14. A. FIMBRIATUM.
Scape stout, 1 to 3 inches high : leaf flat : stigma entire : perianth little exceeding the stamens. N. W. Nevada.
Perianth nearly white : crests entire. 15. A. NEVADENSE.
Perianth dark red : crests acute, toothed. 16. A. ATRORUBENS.
Leaves 1 to several, linear, much exceeding the very short scape : capsule not crested : perianth-segments narrowly lanceolate, not gibbous.
Scape an inch or two high : bracts 3, long-acuminate. 17. A. TRIBRACTEATUM.
Scape shorter : bracts 2, abruptly acute. 18. A. PARVUM.
Scape flattened, 2-edged, low, from a coated bulb : leaves 2, thick, broad and flat, falcate.
Bracts 2 : stamens included : ovary crested.
Perianth-segments narrowed and spreading above, serrulate : crests 3, narrow, central. 19. A. FALCIFOLIUM.
Segments deep rose-color, lanceolate, erect, not serrulate : crests 3, thick, slightly lobed. 20. A. BREWERI.
Segments nearly white, narrowly lanceolate, lax, scarcely gibbous at base : crests 6, broad, obtuse. 21. A. ANCEPS.
Scape taller (6 inches high) : segments pale rose-color, ovate-lanceolate, gibbous : crests 6, obscure. 22. A. LEMMONI.
Bracts 3 to 5 : stamens somewhat exserted : ovary not crested.
Segments 4 to 7 lines long, very narrowly acuminate. 23. A. PLATYCAULE.

§ 1. *Scape stout and tall, terete, from a small ovate coated corm and propagating by a lateral bulb-bearing offshoot : leaves linear : capsule not crested.*

1. **A. unifolium,** Kell. Bulb deep-seated, 6 to 8 lines long, with a white somewhat chartaceous coat, marked by a close contorted reticulation, separated from the younger bulb above by a rooting rhizome ½ to 1 inch long : leaves 2 to 4, sheathing below the ground, flat or somewhat carinate, 1 to 4 lines broad, shorter than the scape, which is a foot or two high : bracts 2, large, acuminate : pedicels 10 to 30, usually 1½ inches long : flowers bright rose-color fading to white, the broadly oblong-lanceolate acute or somewhat acuminate segments 5 to 7 lines long, a third longer than the stamens and style. — Proc. Calif. Acad. ii. 112, fig. 35 ; Watson, Bot. King Exp. 486, t. 36, fig. 9, 10 ; Baker, Bot. Mag. t. 6320. *A. falcifolium,* Torr. Pacif. R. Rep. iv. 148, in part. *A. Douglasii,* Wood, Proc. Philad. Acad. 1868, 170, in part.

In the Coast Ranges from Mendocino County to San Diego ; flowering from March to May or June. A unique species in the character of the bulb.

§ 2. *Scape somewhat compressed and 2-edged, the oblong tunicated bulb crowning a horizontal rhizome : leaves several, linear : capsule scarcely or not at all crested.*

2. **A. validum,** Watson. Scape very stout, 2-edged above, angled below, 1 to 3 feet high : bulb-coats white : leaves 2 to 8 lines broad, somewhat carinate, nearly equalling the scape : bracts 2 to 4, united at base, broad, acute or shortly acuminate : umbel often somewhat nodding ; pedicels numerous, 3 to 6 lines long : flowers rose-color to nearly white, the lanceolate narrowly acuminate segments 3 or 4 lines long, about equalling or shorter than the stamens and style : capsule subglobose, not crested, 2½ lines long. — Bot. King Exp. 350 ; Proc. Amer. Acad. xiv. 226.

In the Sierra Nevada, from above Owen's Lake (*Brewer*) to Oregon (*Nevius, Cusick*), in moist places at an altitude of 7,000 to 11,000 feet or more; also in the E. Humboldt Mountains, Nevada (*Watson*); July to September.

3. **A. hæmatochiton**, Watson, l. c. 227. Scape low, slender, 4 to 12 inches high: coats of the narrow bulb deep reddish purple, shining: leaves flat and rather thick, a line or two broad, about equalling the scape: bracts 2, short, connate: umbel erect or somewhat nodding; pedicels 10 to 20, a half-inch long or less: flowers deep purple or rose-color, the ovate-lanceolate acute segments 3 or 4 lines long, a little exceeding the very slender stamens and style: ovary truncate, with very short rounded crests: capsule obcordate, 2 lines long.

On sides of dry rocky hills near San Luis Obispo (*Brewer*) and near Ojai (*Peckham*); April.

§ 3. *Scape terete (rarely angled), slender, from a small ovate or globose bulb without rhizome: leaves narrowly linear: bulb-coats membranous, often more or less distinctly reticulated: stamens included, except in* n. 6.

* *Leaves* 2 *or more, shorter than or about equalling the scape* (4 *to* 10 *inches high or more).*

+– *Ovary rather obscurely crested: perianth-segments (at least the inner ones) serrulate, bright rose-color.*

4. **A. acuminatum**, Hook. Outer bulb-coats with a distinct rather coarse and prominent quadrate to hexagonal reticulation: scape 6 to 10 inches high, usually exceeding the leaves which are a line broad or less: bracts narrowly acuminate: pedicels (12 to 30) 6 to 12 lines long: flowers deep rose-color, the lanceolate segments 4 to 7 lines long, with acuminate recurved tips, rigid in fruit, a third longer than the stamens: filaments slightly dilated below: crest very short, becoming obsolete. — Fl. Bor.-Am. ii. 184, t. 196; Lindl. in Paxt. Fl. Gard. t. 25; Watson, Bot. King Exp. 352, t. 37, fig. 6 (reticulation). *A. Murrayanum*, Hort. Edinb.; Regel, Gartenfl. 1874, t. 770. *A. Elwesii*, Regel, Pl. Nov. fasc. 5.50 ?

From Washington Territory to N. California and eastward to N. Utah, but rarely collected within our limits. It is reported from Cape Mendocino (*Douglas*), and specimens from the Nacismento River (*Brewer*, n. 555) appear to belong here.

5. **A. Bolanderi**, Watson. Resembling the last: bulbs (or rather coated corms) sometimes clustered, oblique, the coats with an obscure delicate close undulate-serrate reticulation: scape lateral, very slender: pedicels 5 to 15, slender, 4 to 9 lines long: flowers rose-color or pinkish, the very narrowly acuminate segments nearly straight, 4 or 5 lines long, twice longer than the stamens and style: filaments filiform, adnate to the middle. — Proc. Amer. Acad. xiv. 229.

Humboldt County, on the Eureka trail (*Bolander*, n. 6556; *Rattan*); also by *Kellogg & Harford* (n. 1011), probably in the same region. The species is peculiar in often sending off one or two secondary bulbs from the base of the stem, which take root at the distal end and send up a scape from the same point.

+– +– *Ovary distinctly* 6*-crested (obscurely so in* n. 10): *perianth-segments not serrulate.*

++ *Scapes rather tall: flowers numerous; perianth white or light-pink, becoming thin and lax.*

6. **A. Sanbornii**, Wood. Scape slender, a foot or two high, from a white ovate bulb: reticulation minute and very irregular: umbel erect or nodding, subtended by 4 lanceolate acuminate bracts: pedicels 3 to 6 lines long: flowers light rose-color, small, the ovate-lanceolate segments 2½ or 3 lines long, shorter than the stamens and style: capsule very thin. — Proc. Philad. Acad. 1868, 171; Watson, Bot. King Exp. 486, t. 37, fig. 7 (flower).

In the Sierra Nevada from Yuba County to the Yosemite.

7. **A. attenuifolium,** Kell. Bulb-coats (often reddish) with a delicate transversely sinuate or serrate reticulation, the vertical lines especially also minutely sinuous: scape slender, 6 to 15 inches high, somewhat leafy: leaves narrow and becoming convolute-filiform above the sheathing base: bracts 2, short, abruptly acute: umbel erect, usually dense; pedicels 3 to 8 lines long: flowers white or nearly so, the oblong-lanceolate acuminate segments 3 or 4 lines long, more or less exceeding the stamens and style. — Proc. Calif. Acad. ii. 110, fig. 34; Watson, l. c. t. 37, fig. 8, 9 (flower and reticulation). *A. reticulatum,* Benth. Pl. Hartw. 339. *A. amplectens,* Torr. Pacif. R. Rep. iv. 148. *A. acuminatum,* var. *gracile,* Wood, l. c. 170. *A. occidentale,* Gray, Proc. Amer. Acad. vii. 390.

Frequent in the Sierra Nevada from Mariposa County to Oregon (*Hall*), and also in the Coast Ranges from San Francisco northward. The reticulation is usually more regularly sinuate or serrate than is represented in the figure in Bot. King Exp., often approaching that of *A. serratum,* from which species this may be distinguished by the lax whitish flowers and obtuser bracts. Dr. Torrey's name is the earlier, but is applicable only to the undeveloped state of the plant when, as in other species, the umbel is enclosed in the spathe.

++ ++ *Scape low: perianth rose-colored, not becoming lax.*

= *Filaments more or less deltoid above the discoid adnate base.*

8. **A. serratum,** Watson. With the habit of *A. acuminatum:* bulb-coats with a distinct close horizontally serrate denticulation: bracts narrowly acuminate: perianth-segments broadly ovate-lanceolate, 4 to 6 lines long, acute or somewhat acuminate, nearly straight and rather rigid, the inner narrower, somewhat shorter and rarely serrulate: filaments all with a narrowly deltoid base: crests very narrow, central. — Bot. King Exp. 487, t. 37, fig. 4 (reticulation). *A. acuminatum* and *falcifolium,* Torr. Pacif. R. Rep. iv. 148, mainly.

In the Coast Ranges, from Marin County southward, and in the foothills of the Sierra Nevada; apparently also from San Diego, on gravelly hills, *Cooper;* April to June. A common form has rather close umbels, the small flowers (4 lines long) on pedicels a half inch long or less. The dried outer bulb-coats are readily fissile along the transverse lines of reticulation.

9. **A. bisceptrum,** Watson. Bulb-coats light-colored, with an indistinct somewhat quadrilateral reticulation, the cells under a strong power showing an exceedingly sinuous outline especially along the vertical lines: scapes 4 to 10 inches high, often in pairs, rarely compressed above or angled: leaves 1 to 3 lines broad, or more: pedicels 15 to 40: flowers deep rose-color to nearly white, the ovate-lanceolate acute or acuminate segments 3 or 4 lines long, erect, slightly exceeding the stamens: crests thin, conspicuous. — Bot. King Exp. 351, t. 37, fig. 1–3. *A. falcifolium,* Torr. l. c., in part. *A. Douglasii,* Wood, l. c., in part.

A rather common species in the mountains from the Sierra Nevada to Utah.

10. **A. lacunosum,** Watson. Bulb-coats light-colored, thick and distinctly pitted by the quadrate or transversely oblong reticulation, the outlines of the cells very minutely sinuous: scape 3 to 6 inches high: flowers (5 to 20) on pedicels 3 to 5 lines long, the oblong-lanceolate acuminate segments 3 or 4 lines long, a little exceeding the stamens: filaments narrowly deltoid at base: ovary-cells with an obtuse thickened ridge toward the summit on each side. — Proc. Amer. Acad. xiv. 231.

On Mariposa Peak, Santa Clara County (*Brewer,* n. 1284).

= = *Filaments filiform: crests conspicuous.*

11. **A. campanulatum,** Watson, l. c. Bulb-coats with a very minute and extremely sinuate reticulation: scape 4 to 10 inches high: umbel erect or somewhat nodding, many-flowered, the slender pedicels 6 to 15 lines long: flowers light rose-color, the thin spreading broadly ovate-lanceolate acute or abruptly and shortly acuminate segments 3 or 4 lines long, a third longer than the stamens: ovary distinctly crested.

In the Sierra Nevada, Mariposa and Plumas Counties (*Bolander*, n. 4943, and *Mrs. M. E. P. Ames*); on Klamath River, *Rattan*.

12. **A. Bidwelliæ**, Watson, l. c. Bulb-coats unknown: scape 2 or 3 inches high: umbel rather few-flowered, the pedicels a half-inch long: flowers bright rose-color, the erect narrowly lanceolate acuminate segments 2½ or 3 lines long, scarcely exceeding the stamens and style: crests conspicuous.

In the Sierra Nevada, above Chico, *Mrs. J. Bidwell*.

* * *Leaf solitary, narrowly linear or filiform, equalling or somewhat exceeding the low scape (2 to 6 inches): crests 6, prominent: stamens included.*

+ *Stigma of 3 linear lobes: scape very slender: leaf revolute-filiform: bracts abruptly setaceous-acuminate.*

13. **A. Parryi**, Watson, l. c. Bulb-coats reddish-brown, without reticulation: pedicels (12 to 30) 4 to 8 lines long: flowers rose-colored, the lanceolate acuminate segments 3 or 4 lines long, a third longer than the stamens: crests emarginate or erose.

In the Coast Ranges of San Bernardino County, *Dr. C. C. Parry*, n. 390, 1876.

14. **A. fimbriatum**, Watson. Bulb unknown: scape 3 inches high, shorter than the leaf: flowers deep rose-color, on pedicels 3 to 6 lines long, the lanceolate acuminate segments nearly twice longer than the stamens and style: crests fimbriate. — Proc. Amer. Acad. xiv. 232.

On the Mohave River, *Dr. E. Palmer*.

+ + *Stigma not divided: scape stout, 1 to 3 inches high: leaf flat: bracts more acuminate.*

15. **A. Nevadense**, Watson. Bulb-coats light-colored, with distinct very much distorted reticulation: bracts 2: flowers white or pinkish, on pedicels a half-inch long, the lanceolate acute or shortly acuminate segments 4 lines long, little exceeding the stamens and style: crests acutish or obliquely truncate, entire or nearly so. — Bot. King Exp. 351, t. 38, fig. 1 – 3.

From the eastern base of the Sierra Nevada (*Anderson, Watson*) to Utah; May to July.

16. **A. atrorubens**, Watson. Bulb-coats without known reticulation: leaves a line or two broad: bracts 3: pedicels (about 20) a half-inch long: flowers reddish purple, the spreading lanceolate acuminate segments 5 or 6 lines long, little exceeding the very slender stamens: crests acute, laciniately toothed. — Bot. King Exp. 352, t. 38, fig. 4, 5.

On dry foothills in N. W. Nevada (*Watson*); June.

* * * *Leaves usually 2 or more, linear, much exceeding the very short scape: capsule not crested: perianth-segments narrowly lanceolate, not gibbous.*

17. **A. tribracteatum**, Torr., l. c. Bulb-coats thin with distinct transversely oblong reticulation: scape slender, rarely 2 inches high: leaves ½ to 3 lines broad: bracts 3, long-acuminate: pedicels slender, 2 or 3 lines long: flowers pinkish with darker midveins, the narrowly oblong-lanceolate acutish segments 3 lines long, little exceeding the stamens. — Watson, l. c. 353 (excl. var.), t. 38, fig. 6, 7.

In the Sierra Nevada, Mono and Nevada Counties, to an altitude of 10,000 feet; Duffield's Ranch (*Bigelow*); near Cisco (*Bolander*); peak above Mono Lake, *Brewer*.

18. **A. parvum**, Kell. Resembling the last: scape scarcely rising above ground, and bulb-coats without reticulation: bracts 2, short, abruptly acute: perianth-segments broader, more obtuse, 3 or 4 lines long. — Proc. Calif. Acad. iii. 54, fig. 13. *A. tribracteatum*, var. *Andersoni*, Watson, l. c.

In the valleys and on dry ridges on the eastern side of the Sierra Nevada; near Carson City (*Anderson, Watson*); Sierra Valley, *Lemmon*.

§ 4. *Scape much flattened and 2-edged, short, from an ovate coated bulb: leaves 2, thick, broadly linear, flat and falcate.*

* *Bracts 2: stamens included: ovary mostly crested.*

19. **A. falcifolium**, Hook. & Arn. Bulb-coats not reticulated: scape 2 or 3 inches high, 1 or 2 lines broad: leaves 3 or 4 lines broad: flowers rose-colored, the lanceolate segments attenuate and spreading above, minutely glandular-serrate, 4 to 6 lines long, nearly twice longer than the stamens and style: capsule acute with 3 short narrow central crests. — Bot. Beechey, 400; Watson, l. c. 488, t. 36, fig. 7, 8 (flower).

In the Coast Ranges, from Sonoma to Humboldt Counties (*Douglas, Bolander*) and southwestern Oregon (*Rattan*); Siskiyou County, *Lemmon*.

20. **A. Breweri**, Watson. Bulbs large, 6 to 9 lines in diameter, the coats without reticulation: scape an inch or two above ground, a line or two broad: leaves 2 to 5 lines broad: bracts acute: flowers deep rose-color, the lanceolate acute segments nearly erect, 5 or 6 lines long, a third longer than the stamens: ovary and capsule with a thick slightly lobed crest upon each cell. — Proc. Amer. Acad. xiv. 233.

Summit of Mount Diablo, in dry sunny places (*Brewer*, n. 1060); May.

21. **A. anceps**, Kell. Bulb-coats with minute transversely oblong reticulation: scape 2 or 3 inches high and 2 lines wide: bracts acute: pedicels lax, 6 to 8 lines long: flowers nearly white with purplish midveins, the very narrowly lanceolate acuminate lax segments scarcely gibbous at base, 3 or 4 lines long, little exceeding the stamens: crests 6, broad, obtuse. — Proc. Calif. Acad. ii. 109, fig. 32; Watson, Bot. King Exp. 352, t. 36, fig. 4–6 (capsule faulty).

East base of the Sierra Nevada, from Carson City to Oregon.

22. **A. Lemmoni**, Watson. Scape 6 inches high: leaves nearly straight: flowers rather numerous, pale rose-color, on pedicels 6 to 8 lines long, the ovate-lanceolate acuminate segments gibbous at base, 4 lines long, a little exceeding the stamens: crests 6, broad, obscure. — Proc. Amer. Acad. xiv. 234.

In the Sierra Nevada, Sierra County, *J. G. Lemmon*.

* * *Bracts 3 to 5: stamens somewhat exserted: ovary not crested.*

23. **A. platycaule**, Watson, l. c. Bulb-coats without reticulation: scape stout, 3 to 5 inches high, 2 to 4 lines broad: leaves 6 to 12 lines broad: bracts acuminate: pedicels very numerous, an inch long or less: flowers rose-color, the lanceolate very narrowly long-acuminate segments 4 to 7 lines long. — *A. anceps*, Baker, Bot. Mag. t. 6227.

In the high valleys of the Sierra Nevada, from near Cisco to Plumas County.

2. MUILLA, Watson.

Perianth subrotate, persistent, of 6 nearly equal slightly united oblong-lanceolate segments, greenish or yellowish white with darker 2-nerved midveins. Stamens near the base, with naked filiform filaments slightly thicker at base; anthers ovate-oblong, versatile. Ovary sessile, ovate-oblong; cells 8–10-ovuled; style clavate, persistent and at length splitting. Capsule globose, scarcely lobed, loculicidally dehiscent. Seeds ascending, oblong, compressed and angled, with thin dull-black testa. — Scape from a fibrous-coated corm, bearing an umbel subtended by several small scarious bracts; leaves very narrow, semi-terete; pedicels not jointed; not alliaceous. A single species. — Proc. Amer. Acad. xiv. 215.

1. **M. maritima**, Watson, l. c. 235. Corm small (less than a half-inch thick), with thin fibro-membranous coats: leaves several, not sheathing at base, scabrous,

equalling the very slender scabrous scape (3 to 12 inches high), a half to one line wide: bracts 4 to 6, lanceolate to linear, 2 to 4 lines long: pedicels 5 to 15, very slender, unequal, 2 to 12 lines long: perianth-segments 2 or 3 lines long, somewhat sacculate at the tip: anthers ½ line long: style about equalling the acute ovary: capsule 3 lines long, abruptly beaked by the short stout style: seeds 1½ lines long. — *Hesperoscordium* (?) *maritimum*, Torr. Pacif. R. Rep. iv. 148. *Allium maritimum*, Benth. Pl. Hartw. 339; Torr. Bot. Mex. Bound. 217; Regel, All. Monogr. 219. *Milla maritima*, Watson, Bot. King Exp. 354.

Near the coast, from Marin County to Monterey; also in Western Nevada, in somewhat alkaline localities, from Carson City to Sierra Valley, apparently identical, though with slightly larger flowers.

3. BLOOMERIA, Kellogg.

Perianth persistent, of 6 nearly equal distinct linear-oblong segments, somewhat spreading, orange with a darker closely double or triple midnerve. Stamens 6, on the base of the segments and a little shorter; filaments filiform, with a somewhat cup-shaped winged and bi-cuspidate appendage surrounding the base, not adnate to the perianth; anthers oblong, attached near the base but versatile. Ovary sessile, subglobose: ovules several in each cell: style filiform-clavate, persistent and splitting with the capsule. Capsule subglobose, membranous, obtusely 3-lobed, loculicidally dehiscent. Seeds 4 to 8 in each cell, subovoid, angular and wrinkled, with thin dull black testa. — Scape from a fibrous-coated corm, bearing a many-rayed umbel subtended by membranous bracts; leaves linear, carinate; pedicels jointed at the summit. A single species. — Proc. Calif. Acad. ii. 11.

1. **B. aurea**, Kell. l. c. Bulb small (a half-inch in diameter), becoming densely covered with brownish fibres: leaf solitary, equalling or exceeding the scape, 3 to 6 lines broad: scape scabrous, 6 to 18 inches high: bracts several, narrowly lanceolate: pedicels numerous (15 to 60), 1 to 2½ inches long: perianth subrotate in bloom; segments 4 to 6 lines long: appendage at the base of the filaments nearly a line long, minutely papillose, the lateral cusps variable in length: capsule beaked with the persistent style, nearly 3 lines long. — Watson, Proc. Amer. Acad. xiv. 235. *Allium* (*Chrysoscordium*) *croceum*, Torrey, Bot. Mex. Bound. 218; Regel, All. Monogr. 215. *Nothoscordum aureum*, Hook. f. Bot. Mag. t. 5896.

Southern California, in the Coast Ranges from Monterey County to San Diego, and eastward; Kern County (*Kennedy*); near Mohave River, *Palmer*. May to July.

4. BRODIÆA, Smith.

Perianth persistent, funnelform, often narrowly so, not contracted at the throat, nor saccate or but slightly so at base, blue-purple or sometimes yellow or white; segments 1-nerved. Stamens 3 on the throat opposite the inner lobes and alternate with as many oblong or linear staminodia, or 6 in one or two rows with the filaments naked or appendaged; anthers basifixed or versatile. Ovary stipitate or sessile; style persistent, about equalling the anthers, with short diverging entire stigmas; cells 3–8-ovuled. Capsule ovate to oblong, more or less attenuate above. Seeds angled, black. — Scape usually erect, with linear leaves, from a fibro-membranous-coated corm, bearing a several-bracted umbel of few to many flowers on jointed pedicels: brown-coated corms small, ½ to ¾ inch in diameter or less. — *Hookera*, Salisb. Parad. Lond. 98. *Brodiæa*, Smith, Linn. Trans. x. 2; Baker, Journ. Linn. Soc. xi. 375, in part. *Triteleia*, Lindl. Bot. Reg. under t. 1293, in part. *Hesperoscordum*, Lindl. l. c. *Calliprora*, Lindl. Bot. Reg. under t. 1590.

Dichelostemma and *Seubertia*, Kunth, Enum. iv. 469 & 475. *Themis*, Salisb. Gen. 85. *Milla*, Baker, l. c. in part, not Cav.

A genus peculiar to California and the adjacent region, not reaching the southern boundary. Though polymorphous in its characters, yet it is on the whole distinctly marked, and clearly separated from the Mexican genus *Milla*, to which many of the species are referred by Mr. Baker. The latter is distinguished by its salverform perianth with 3-nerved segments, its inarticulate pedicels, sessile ovary, and southern habitat. The single Mexican species, *M. biflora*, Cav., is also found in New Mexico and southeastern Arizona.

* *Stamens in one row on the throat; anthers basifixed: capsule subsessile: perianth purple, mostly broadly funnelform, the tube shorter than the limb.* — EUBRODIÆA.

\+ *Stamens 3, opposite to the inner segments, the outer stamens being reduced to staminodia: segments 2 or 3 times longer than the tube.*

++ *Pedicels more or less elongated.*

1. **B. grandiflora**, Smith. Leaves a line broad, thick and somewhat terete, about equalling the smooth scape, which is 4 to 10 inches high: pedicels 3 to 10 (or rarely solitary), unequal, ½ to 2 (or even 3 or 4) inches long: perianth varying from purple to light rose-color, 10 to 20 lines long, the linear-oblong obtuse or acutish segments strongly 1-nerved: filaments rather slender, 1½ lines long or more, the anthers twice longer; staminodia ligulate, entire, obtuse, whitish, about equalling the anthers: capsule sessile, narrowed at base, oblong, and attenuate into the stout rigid style; cells 6–8-seeded: seeds a line long. — Trans. Linn. Soc. x. 2; Lindl. Bot. Reg. t. 1183; Hook. Bot. Mag. t. 2877; Baker, l. c. 376, in part.

Var. (?) **major**, Benth. Taller and stouter, a foot or two high; scapes often scabrous; leaves 1 to 3 lines broad and flattened: pedicels 6 to 20, mostly 1 to 4 inches long: perianth often 1½ inches long or more, with long narrow segments and staminodia; anthers and filaments twice longer: capsules sometimes strictly sessile with a broad base and the seeds 2 lines long. — Pl. Hartw. 339; Baker, l. c. *B. Californica*, Lindl. Trans. Hort. Soc. iv. 84, & fig.

From S. California (on the Mohave River, *Palmer*) to the British Boundary; in the Sierra Nevada and foothills. The brown-coated corms are from half an inch to nearly an inch in diameter. The broader leaved variety, with broader capsule and larger seeds, may prove distinct.

2. **B. minor**, Watson. Scape very slender, 3 to 6 inches high, smooth, bearing an umbel of 2 to 6 rays an inch or two long: perianth 7 to 14 lines long: anthers oblong, 2 lines long, shorter than the broadly ligulate usually emarginate staminodia: capsule obovate, sessile or nearly so, 3 lines long, acute, the cells 3-seeded: seeds a line long. — Proc. Amer. Acad. xiv. 236. *B. grandiflora*, var. *minor*, Benth. Pl. Hartw. 340. *B. grandiflora*, Baker, l. c., in part.

In various parts of California (*Hartweg, Wallace, Coulter*) and Oregon, *Kellogg & Harford.*

3. **B. terrestris**, Kell. Leaves nearly terete: scape very short, scarcely rising above the surface of the ground: pedicels 2 to 10, very slender, 3 or 4 inches long: perianth 8 to 10 lines long: anthers oblong, sagittate, 1½ lines long, slightly longer than the filaments, shorter than the yellowish emarginate staminodia: capsule ½ inch long, including the short stout style, sessile, acute at base; cells 6–8-seeded: seeds nearly a line long. — Proc. Calif. Acad. ii. 6. *B. grandiflora*, var. *macropoda*, Torr. Pacif. R. Rep. iv. 149. *B. Torreyi*, Wood, Proc. Philad. Acad. 1868, 172.

A very common species about San Francisco and through Central California, from Mendocino County (sandy plains near Fort Bragg, *Bolander*) to Monterey.

++ ++ *Flowers subcapitate, on short pedicels.*

4. **B. congesta**, Smith. Corm often deep-seated: scapes 2 to 4 feet high, smooth; leaves 2 to 6 lines broad, carinate, glaucous: umbel often more or less produced into a short dense raceme: pedicels 6 to many, 1 to 3 lines long: perianth 8

or 9 lines long, the oblong-lanceolate segments twice longer than the tube: anthers very nearly sessile, deeply emarginate at each end, 2 to 3 lines long: staminodia deeply cleft, exceeding the anthers: capsule sessile, ovate, 5 lines long including the short thick style; cells several-ovuled, usually 1-seeded: seed 2 lines long. — Trans. Linn. Soc. x. 3, t. 1; Baker, l. c. 377. *Dichelostemma congestum*, Kunth, Enum. iv. 470; Wood, l. c. 173.

From San Francisco to Washington Territory, common.

5. **B. multiflora**, Benth. Much resembling the last, but the corm less deeply seated, and flowering a month or two earlier: scape a foot or two high, somewhat scabrous; umbel not produced: staminodia entire, broad and obtuse, about equalling the anthers: seeds several in each cell. — Pl. Hartw. 339; Baker, l. c.; Hook. f. Bot. Mag. t. 5989. *B. parviflora*, Torr. & Gray, Pacif. R. Rep. ii. 125; Wood. l. c. 172. *B. grandiflora*, var. *brachypoda*, Torr., same, iv. 149.

From the Sacramento Valley to Oregon, and in the Sierra Nevada.

+– + *Stamens* 6, *the inner with a free lanceolate appendage on each side, the outer ones naked: flowers subcapitate; segments little longer than the tube.*

6. **B. capitata**, Benth. Leaves a foot long or more, 2 to 10 lines wide, carinate, usually glaucous: scape a foot or two high, sometimes much shorter than the leaves: flowers few to many, nearly sessile, or on pedicels 1 to 6 lines long: perianth rather broadly funnelform, 6 to 10 lines long, from blue or purple to white: inner anthers nearly sessile, linear, 2 lines long, slightly shorter than the oblong-lanceolate appendages; the outer smaller, on short naked filaments broadly dilated at base: capsule ovate, sessile, 3 lines long, beaked by the slender style nearly as long: seeds several in each cell, 2 lines long. — Pl. Hartw. 339. *Hookera pulchella*, Salisb. Parad. t. 117? *Dichelostemma capitata*, Wood, l. c. 173. *Milla capitata*, Baker, l. c. 381; Oliver, Hook. Bot. Mag. t. 5912.

Frequent through California from San Bernardino northward; also eastward in the mountains to S. Utah. February to May.

* * *Stamens in* 2 *rows* (*except in* n. 8), *with more or less distinctly versatile anthers and naked filaments: capsule stipitate: perianth-tube mostly narrow, equalling or longer than the segments.* — SEUBERTIA.

+– *Perianth broadly tubular: flowers subcapitate.*

7. **B. Douglasii**, Watson, l. c. 237. Leaves 2 to 6 lines broad, carinate: scape smooth, a foot or two high, erect and usually stout: pedicels few to many, 1 to 12 lines long: perianth 8 to 12 lines long, blue; tube subsaccate, about equalling the lobes: anthers oblong, a line long; the lower on the throat opposite the outer segments, the upper on the inner segments, on a short free filament which forms below a prominent wing within the tube: capsule ovate, 3 lines long, a little exceeding the stipe and the slender style: seeds several in each cell. — *Triteleia grandiflora*, Lindl. Bot. Reg. under t. 1293; Hook. Fl. Bor.-Am. ii. 186, t. 198, B. *B. grandiflora*, Torr. in Stansb. Rep. 397. *Milla grandiflora*, Baker, l. c. 380.

Washington Territory and Oregon, and eastward to W. Wyoming and the Wahsatch; probably to be found in Northern California.

+– + *Perianth more or less attenuate at base: umbel open.*

++ *Flowers blue or purplish, rarely white.*

8. **B. Bridgesii**, Watson, l. c. Scape a foot high or more: pedicels 10 to 20, ½ to 2 inches long: perianth 12 to 15 lines long, the tube very narrow and exceeding the lobes: stamens in one row on the throat, the nearly equal filaments dilated downward, 1½ lines long: anthers linear, 2 lines long: capsule ovate, 4 lines long, shorter than the stipe, beaked by the very slender style: seeds 2 or 3 in each cell, 1½ lines long.

Collected by *William Bridges* (n. 338), in Central California; near Chico (*Mrs. J. Bidwell*); other specimens are in herb. Gray, but the collectors and locality are uncertain.

9. **B. laxa**, Watson, l. c. Scapes smooth or scabrous, ½ to 2 feet high, erect: pedicels few to many, 1 to 3 inches long: perianth very narrow below, 12 to 20 lines long, the tube equalling or exceeding the lobes: anthers oblong to linear, 1½ to 2½ lines long, on very slender short or more or less elongated filaments, the upper on the throat opposite the inner segments, the lower on the tube: capsule on an elongated stipe, oblong, 4 to 6 lines long, beaked by the rather short thick style: seeds several in each cell, a line long. — *Triteleia laxa*, Benth. in Trans. Hort. Soc. i. 413, t. 15; Lindl. Bot. Reg. t. 1685. *Seubertia laxa*, Kunth, Enum. iv. 475. *Milla laxa*, Baker, l. c. 384. Flowers sometimes white.

In the Coast Ranges from Humboldt County (*Rattan*) to San Francisco.

10. **B. peduncularis**, Watson, l. c. Scapes erect, slender, 1 to 2 feet high, smooth: pedicels 10 to 20, very slender, 2 or 3 inches long: perianth 6 to 9 lines long, the lobes a little exceeding the turbinate tube: anthers narrowly oblong, 1½ lines long, the lower sessile on the tube, the upper on short filaments upon the inner segments: capsule on a stipe a line or two long, beaked by the short style; cells 3–5-seeded. — *Triteleia peduncularis*, Lindl. Bot. Reg. under t. 1685. *Milla peduncularis*, Baker, l. c. 384.

Apparently rather rare; collected by *Douglas*, *Fremont*, and in Lake County by *Dr. Torrey*.

++ ++ *Flowers yellow, with brown nerves.*

11. **B. crocea**, Watson, l. c. 238. Leaves 2 to 6 lines broad: scape rather stout, a foot high or more, smooth: bracts narrowly linear, acuminate, elongated: pedicels 6 to 15, slender, ½ to 2 inches long: perianth 7 to 9 lines long, the segments rather exceeding the turbinate tube: anthers scarcely a line long, on short filaments slightly dilated downward, the lower nearly sessile on the tube, the upper on the inner segments: ovary pubescent on the angles: capsule obovate, on a short stipe, rather abruptly narrowed into the style; cells 4-seeded. — *Seubertia crocea*, Wood, Proc. Acad. Philad. 1868, 172. *Milla crocea*, Baker, l. c. 384.

Near Yreka, Siskiyou County, *Wood*, *Greene*. In flower, May and June.

12. **B. gracilis**, Watson, l. c. Leaves solitary, 1 to 3 lines broad, exceeding the slender scape, which is 2 to 4 inches high, purplish and scabrous: bracts short, lanceolate: pedicels rather few, a half to an inch long: perianth 5 to 7 lines long, deep yellow with brown nerves, the narrow segments about equalling the narrow tube: anthers half a line long, on very slender elongated filaments inserted near the throat: capsule ovate-oblong, on a slender stipe, attenuate into the narrow style; cells 2-seeded.

On Spanish Peak, Plumas County, near Gold Lake, *Mrs. R. M. Austin*.

* * * *Stamens in one row, with deltoid or wing-dilated filaments and versatile anthers: capsule stipitate: perianth-tube turbinate, about half as long as the segments: pedicels more or less elongated.* — § CALLIPRORA.

13. **B. ixioides**, Watson, l. c. Scape mostly erect, 3 inches to 2 feet high, usually scabrous: pedicels few to many, usually an inch or two (sometimes 3 or 4 inches) long: perianth yellow or yellowish, more or less tinged with purple, or nearly white, with a brown midvein (often double or triple), 5 to 10 lines long: filaments winged their whole length, the inner ones longest; the narrow cusps of the wings usually equalling the oblong anthers (a line long or less): capsule ovate-oblong, with a short narrow beak, on a stipe 2 or 3 lines long: seeds several in each cell, a line long. — *Ornithogalum ixioides*, Ait. f. Hort. Kew. ii. 257. *Calliprora lutea*, Lindl. Bot. Reg. t. 1590; Hook. Bot. Mag. t. 3588. *Themis ixioides*, Salisb. *Calliprora aurantea*, Kellogg, Proc. Calif. Acad. ii. 20. *Milla ixioides*, Baker, l. c. 383.

Frequent from Santa Barbara and Fort Tejon to Oregon; also in the Sierra Nevada to an altitude of 9,000 feet.

14. **B. lactea**, Watson, l. c. Scapes usually a foot or two high, smooth or scabrous: pedicels few to many, slender, ½ to 2 inches long: perianth white with a green midvein, or sometimes purplish, 4 or 5 lines long: filaments equal, deltoid, usually about a line long: anthers small, oblong, yellow or purple: capsule subglobose, abruptly beaked by the short slender style; stipe usually a line or two long: seeds 2 to 6 (ovules 8 or 10) in each cell, a line long. — *Hesperoscordum hyacinthinum*, Lindl. Bot. Reg. under t. 1293. *H. lacteum*, Lindl. l. c. t. 1639; Wood, l. c. 171. *H. Lewisii*, Hook. Fl. Bor.-Am. ii. 185, t. 198. *Allium lacteum*, Benth. Pl. Hartw. 339. *Veatchia crystallina*, Kellogg, l. c. ii. 11. *Milla hyacinthina*, Baker, l. c. 385. *Allium Tilingi*, Regel, All. Monogr. 124.

Var. **lilacina**, Watson, l. c. A stout form, with large flowers (5 to 7 lines long), from white becoming more or less tinged with lilac.

Frequent through California, from Monterey to British Columbia; above Carson City (*Anderson*); Plumas County, *Mrs. Austin*. The variety from Mendocino and Humboldt Counties.

5. STROPHOLIRION, Torr.

Perianth persistent, rose-colored, short-funnelform, contracted at the throat, the 6-saccate and 6-angled tube nearly equalling the spreading 1-nerved segments. Stamens 3, on the throat opposite the inner segments, alternate with 3 ligulate, emarginate staminodia; filaments very short, with a lanceolate wing each side; anthers linear-sagittate, basifixed. Ovary nearly sessile, with short persistent style; cells 4-ovuled. Capsule ovate, acuminate, on a short stipe. Seeds angled, black, usually one in each cell. — Scape elongated and climbing, from a coated corm, bearing a many-flowered umbel with jointed pedicels; leaves broadly linear. A single Californian species. — *Rupalleya*, Morière.

1. **S. Californicum**, Torr. Corm nearly an inch in diameter: leaves a foot long or more, 4 to 6 lines broad, carinate: scape roughish, 2 to 4 (or even 12) feet long, lax and often twining over bushes: pedicels numerous (15 to 30), slender, mostly a half to an inch long: perianth 5 or 6 lines long, with oblong-lanceolate segments: anthers 2 lines long, equalling the lanceolate acute wings and narrow often pubescent staminodia: capsule 4 lines long, including the style, narrowed at base: seed 2 lines long. — Pacif. R. Rep. iv. 149, t. 21. *Rupalleya volubilis*, Morière, Bull. Soc. Linn. Norm. viii. 313, & plate. *Dichelostemma Californica*, Wood, Proc. Acad. Philad. 1868, 173. *Brodiæa volubilis*, Baker, Journ. Linn. Soc. xi. 377; Hook. f. Bot. Mag. t. 6123.

Common in the foothills of the Sierra Nevada, from Mariposa County northward, and in the valley of the Sacramento.

6. BREVOORTIA, Wood.

Perianth persistent, deep scarlet, rather broadly tubular, shortly 6-saccate at the truncate base, slightly constricted above, the short yellowish segments erect or sometimes reflexed, faintly 1-nerved. Stamens 3, on the throat opposite to the inner segments, alternate with 3 very broad truncate coroma-like staminodia; filaments very short, naked; anthers narrowly oblong, basifixed, emarginate at each end. Ovary stipitate, with elongated persistent style; cells 4–6-ovuled. Capsule triangular-ovate, acuminate. Seeds angled, black. — Scape erect, from a coated corm, bearing a few-flowered umbel with jointed pedicels; leaves linear. A single species. — Proc. Philad. Acad. 1867, 82.

1. **B. coccinea,** Watson. Corm 6 to 9 lines in diameter, with reticulated and somewhat fibrous coats, and often with lateral bulblets: leaves a foot or two long or more, 2 to 4 lines wide, carinate, glaucous: scape slender, erect, 1 to 3 feet high, bearing an umbel of 6 to 15 flowers: pedicels 6 to 12 lines long or more, slender: perianth 12 to 16 lines long; the segments ovate, 2 or 3 lines long, greenish-yellow: anthers equalling the limb; staminodia a half shorter, yellow: capsule on a stipe 2 or 3 lines long, ovate-oblong, attenuate upward into the somewhat persistent style: seeds 2 lines long. — Proc. Am. Acad. xiv. 239. *B. Ida-Maia,* Wood, l. c. *Brodiæa coccinea,* Gray, Proc. Am. Acad. vii. 389; Baker, Journ. Linn. Soc. xi. 378; Hook. f. Bot. Mag. t. 5857.

In rich soil in the mountains from Humboldt to Shasta Counties; flowering in May and June. A showy species, very distinct in its coloring.

7. ANDROSTEPHIUM, Torr.

Perianth persistent, pale lilac or purplish, funnelform, 6-cleft, the cylindric tube nearly equalling or shorter than the spreading narrowly oblong 1-nerved segments. Stamens in one row on the throat, the filaments united to form a tubular corona with erect bifid lobes alternate with the oblong versatile anthers. Ovary ovate, sessile, with elongated persistent style. Capsule subglobose, triquetrous. Seeds several in each cell, large, black. — Scape from a somewhat fibrous-coated corm, bearing a few-flowered umbel with inarticulate pedicels; leaves narrowly linear, channelled. Only two species. — Bot. Mex. Bound. 218.

1. **A. breviflorum,** Watson. Corm small: leaves scabrous, a line broad or less: scape rather stout, 4 to 12 inches high, scabrous especially below: flowers 3 to 12, on pedicels ½ to 1½ inches long, light purple, about half an inch long, the tube much shorter than the segments; corona half the length of the limb or more, its lobes equalling or shorter than the anthers (1½ lines long): capsule broader than long (4 or 5 lines), somewhat deeply 3-lobed: seeds 3 or 4 lines long, usually 6 in each cell. — Am. Naturalist, vii. 303.

On gravelly hills near Fort Mohave, rare (*Dr. J. G. Cooper,* in fruit in February), and eastward to S. Utah, *Mrs. Thompson, Bishop, Parry.* The second species (*A. violaceum,* Torr.) is found from Texas to Western Kansas, and differs especially in its larger flowers on shorter pedicels, the tube of the perianth comparatively longer and nearly equalling the limb, and the crown exceeding the anthers; scape usually very low.

8. LEUCOCRINUM, Nutt.

Perianth salver-form with a very slender elongated tube, white, persistent; segments narrowly lanceolate, several-nerved. Stamens 6; filaments filiform, inserted below the throat; anthers linear, attached near the base, introrse. Ovary sessile, ovate-oblong: style persistent, elongated and filiform, equalling the stamens, tubular, the orifice somewhat expanded and slightly 3-lobed: ovules several in each cell. Capsule triangular-obovate, subcoriaceous, loculicidally dehiscent. Seeds obovate, strongly angled, with a dull black testa. — Acaulescent, with a short deep-seated rhizome and fleshy roots, narrowly linear leaves surrounded at base by scarious bracts, and a central sessile umbel of showy fragrant flowers; floral bracts sheathing the pedicels. A single species.

1. **L. montanum,** Nutt. Leaves 8 to 12 or more, flat and rather thick, 4 to 8 inches long and 1 to 3 lines broad, the narrow underground bases (1 to 3 inches long) surrounded by broad scarious acutish bracts; inner bracts very narrow: flowers 4 to 8, on short pedicels (6 to 18 lines long) from the summit of the rhizome: tube

of the perianth an inch or two long; segments 6 to 9 lines long: anthers 2 or 3 lines long: capsule somewhat wrinkled, truncate above, 3 or 4 lines long: seeds 4 to 6 in each cell. — Gray, Ann. Lyc. N. York, iv. 110; Kunth, Enum. iv. 151; Watson, Bot. King Exp. 349, t. 36, fig. 1–3.

In low valleys from Northeastern California to Colorado; near Yreka, in moist alkaline soil on Shasta River (*E. L. Greene*); Lassen County (*Mrs. R. M. Austin*); in dry sandy soil near Carson City and in Humboldt Valley, *Anderson*, *Watson*. Blooming in early spring, the pure white and very fragrant flowers appearing just above the ground.

9. CAMASSIA, Lindl. Camass.

Perianth of 6 distinct oblanceolate 3–7-nerved segments, somewhat spreading, blue (or white), persistent. Stamens 6, on the base of the perianth, shorter than the segments; filaments filiform-subulate; anthers linear-oblong, versatile. Ovary sessile, ovate: ovules several in each cell: style filiform, slightly trifid at the apex, the base persistent. Capsule subglobose or oblong-obovate, 3-lobed and angled, thick-membranaceous, loculicidally 3-valved. Seeds several in each cell, ovate, often more or less compressed or angled, with a thin black and shining wrinkled testa. — Scape slender, from a tunicated bulb; flowers in a simple raceme, with narrow scarious bracts; pedicels jointed at the summit; leaves linear.

An American genus of only two species (the second in the Atlantic States), allied to *Scilla* of the Old World, to which genus it has been referred.

1. **C. esculenta**, Lindl. Scape stout, a foot or two high, from a bulb often an inch in diameter: leaves usually shorter than the scape, carinate, 3 to 8 lines broad: raceme loosely 10–20-flowered; pedicels 3 to 12 lines long, mostly shorter than the narrowly attenuate bracts: flowers from dark blue to nearly white, 7 to 15 lines long; the segments 3-, 5- or 7-nerved: ovary oblong-obovate; ovules 16 to 18 in each cell: style about equalling the perianth, the stamens usually a third or fourth shorter: capsule oblong-obovate, somewhat attenuate at base, 6 to 12 lines long: seeds 1½ lines long. — Bot. Reg. xviii. t. 1486; Torr. Pacif. R. Rep. iv. 147; Lem. Fl. Serres, t. 275. *Phalangium Quamash*, Pursh. *Scilla esculenta*, Hook. Bot. Mag. t. 2774 (white var.).

In meadows and marshes from Middle California (Punta de los Reyes, *Bigelow*; Mariposa County, *Torrey*, &c.) to Washington Territory; also in the Wahsatch Mountains and northward. The bulb is largely collected for food by the Indians. The eastern species (*C. Fraseri*, Torr.) has smaller light-blue flowers, more slender pedicels, and a short acutely angled subglobose capsule.

10. HESPEROCALLIS, Gray.

Perianth regular, white, persistent, funnelform, 6-cleft, the narrowly spatulate segments nearly equal, somewhat spreading, closely 5–7-nerved, twice longer than the cylindrical tube. Stamens 6, on the throat; filaments equal, shorter than the segments, filiform; anthers versatile, linear. Ovary sessile, oblong: ovules numerous: style filiform, equalling the perianth, persistent; stigma depressed-capitate. Capsule subglobose, deeply 3-lobed, membranaceous, loculicidally dehiscent. Seeds horizontal, flattened, in 2 rows in each cell, with dull black thin testa. — Stem stout, somewhat leafy, from a tunicated bulb; leaves linear; flowers large, in a simple raceme, with conspicuous scarious bracts; pedicels jointed at the summit. — Proc. Amer. Acad. vii. 390. A single species.

1. **H. undulata**, Gray, l. c. Bulb ovate: leaves somewhat fleshy, carinate with more or less undulate margin, a foot long and 3 to 6 lines wide, the 2 or 3 cauline ones shorter: stem a foot or two high, 5–8-flowered: bracts dilated, acuminate,

twice longer than the pedicels which are 3 to 6 lines long: perianth 1½ to 2 inches long, the segments 3 or 4 lines broad: capsule half an inch long, acute with the base of the style: seeds thin, 2½ to 3 lines broad. — Am. Journ. Sci. 2 ser. l. c. 427; Baker, Journ. Linn. Soc. xi. 360.

Colorado Desert, near Fort Yuma (*Schott*); near Fort Mohave, in gravelly soil (*Cooper*); at Jessup's Rapids, *Newberry*. Flowering in March and April; bulb eaten by the Indians.

11. HASTINGSIA, Watson.

Perianth white or greenish, lax and becoming scarious but persistent, of 6 distinct oblong closely 3- (apparently 1-) nerved segments. Stamens 6, adnate to the base of the segments; anthers linear-oblong, versatile. Ovary ovate, very shortly stipitate; style short, persistent; cells 2-ovuled. — Stem naked or sparingly leafy, from a coated bulb, bearing a densely many-flowered sparingly panicled raceme, with small scarious bracts; leaves flat, linear; pedicels very short, stout, jointed at the summit. A single species. — Proc. Amer. Acad. xiv. 217.

1. **H. alba,** Watson, l. c. 242. Bulb membranously coated or the outer coats somewhat fibrous: stem and branches erect, often stout, 2 feet high or more: leaves flat, elongated (12 to 18 inches long), 2 to 6 lines broad: racemes elongated, usually dense: pedicels (a line long or less) much shorter than the very narrowly acuminate bracts: flowers white or somewhat tinged with green or pink, 2 or 3 lines long: mature fruit unknown. — *Schœnolirion album,* Durand, Journ. Acad. Philad. 2 ser. iii. 103; Gray, Amer. Naturalist, x. 552.

In the Sierra Nevada from Nevada and Plumas Counties and northward to Siskiyou (in meadows on Shasta River, *Wood, Greene*), in swamps of the Red Mountains, Humboldt County (*Bolander*), and frequent on the Klamath River, *V. Rattan.* The genus commemorates the continued active interest and liberal generosity of Hon. S. Clinton Hastings, of San Francisco, in behalf of the "Botany of California."

12. CHLOROGALUM, Kunth. Soap-plant. Amole.

Perianth white or pinkish, persistent and at length twisted over the ovary, of 6 distinct oblong or narrowly ligulate segments, more or less spreading, with 3 close but distinct greenish or purplish nerves down the middle. Stamens 6, somewhat shorter than the segments, adnate to their base; anthers versatile, linear-oblong. Ovary sessile or very nearly so, subglobose: ovules a pair in each cell, ascending: style filiform, slightly 3-cleft at the apex, deciduous. Capsule thick-membranous, broadly turbinate, 3-lobed, loculicidally dehiscent. Seeds 1 or 2 in each cell, obovate, with a close thin somewhat rugose blackish testa. — Stem stout, scarcely leafy, from a fibrous or membranously coated bulb, bearing a spreading sparingly branched racemose panicle with small scarious bracts; leaves linear, somewhat fleshy and flaccid, the margins more or less undulate; pedicels scattered, jointed at the summit. Only the following species.

* *Perianth-segments narrowly ligulate, spreading widely from the base in the open flower: pedicels nearly equalling the flowers.*

1. **C. pomeridianum,** Kunth. Bulb large, oblong-ovate, densely covered with coarse brown fibres: stem and spreading panicle 1 to 3 feet high, brownish: leaves broadly linear, 6 to 18 inches long, 4 to 10 lines broad, carinate and the margin strongly undulate; the cauline one or two much shorter and attenuate: pedicels slender, ascending, 2 to 9 lines long, much exceeding the bracts: perianth-segments 8 to 10 lines long, white, purplish-veined: capsule 3 lines long, the valves pinnately

nerved: seeds 1½ to 2 lines long. — Enum. iv. 682; Torr. Mex. Bound. t. 60. *Scilla*, DC.; Red. Lil. t. 421. *Anthericum*, Ker, Bot. Reg. t. 564. *Phalangium*, Don in Sweet, Brit. Fl. Gard. 2 ser. t. 381. *Ornithogalum divaricatum*, Lindl. Bot. Reg. xxviii. t. 28.

In the valleys and foothills from the Upper Sacramento (McCumbers, *Newberry*) to the Stanislaus, Monterey and Santa Barbara (Cassetas Pass, *Rothrock*). The bulb is one to four inches in diameter, covered with a thick coat of coarse dark brown fibres. It is frequently used as a substitute for soap, and the bulbs of the other species probably possess the same detergent qualities. The flowers open only after midday, whence the specific name.

* * *Perianth-segments oblong-oblanceolate, somewhat spreading from above the base: pedicels very short.*

2. **C. parviflorum,** Watson. Bulb smaller (an inch thick), with thin membranous coats, the outer dark-colored: stem erect (2 feet high), with slender divaricate branches: leaves narrowly linear and grass-like (2 or 3 lines broad), with undulate margins: pedicels very short (rarely 1 or 2 lines long), mostly shorter than the bracts: flowers 3 or 4 lines long, pinkish: capsule small (scarcely 2 lines in diameter). — Proc. Amer. Acad. xiv. 243.

In Cajon Valley, near San Diego (*D. Cleveland*); flowering in May and June. The bulb-coats, as in the next species, show none of the fibrous character which is so conspicuous in *C. pomeridianum*.

3. **C. angustifolium,** Kellogg. Bulb short-ovoid, membranously coated: stem 1½ to 3 feet high, light green, with spreading branches: leaves linear-lanceolate, 4 to 8 inches long, 2 to 5 lines broad, flat or nearly so, becoming revolute: pedicels a line or two long, about equalling the bracts: flowers white with yellowish green lines, 5 or 6 lines long: ovary oblong-ovate, shortly stipitate. — Proc. Calif. Acad. ii. 105, fig. 30.

Dr. Kellogg's description and figure were based upon cultivated specimens said to have been originally from Shasta; it has also been collected by *Prof. Wood*, on gravelly hills near Yuba, and is probably not rare on the upper Sacramento.

13. ODONTOSTOMUM, Torr.

Perianth white or yellowish, somewhat persistent, tubular with a spreading or reflexed 6-parted limb; segments oblong, about equalling the cylindric 12-nerved tube, the outer 5–7-nerved, the inner 3–5-nerved. Stamens 6, on the throat, alternating with as many very short linear staminodia; filaments very short, narrowly subulate, slightly unequal; anthers ovate-quadrate, basifixed, dehiscent at the summit. Ovary globose, sessile: ovules a pair in each cell, ascending: style filiform, slightly 3-cleft at the apex, deciduous. Capsule triangular-obovate, 3-lobed, loculicidally dehiscent. Seeds solitary, obovate, with a close thin dark brown somewhat rugose testa. — Stem leafy at base, from a fibrous-coated corm, bearing an open racemose panicle with small scarious bracts; leaves flat, broadly linear; pedicels bracteolate in the middle, not jointed. A single species. — Pacif. R. Rep. iv. 150, t. 24.

1. **O. Hartwegi,** Torr. l. c. Corm deep-seated, an inch in diameter: stem a foot or two high, branching from near the base: leaves sheathing at base, 4 to 9 inches long and 3 to 6 lines broad; the cauline short and attenuate: bracts and bractlets very narrow or filiform, about equalling the slender pedicels (1 to 6 lines long or more): flowers rather numerous, 4 to 6 lines long, the segments at length strictly reflexed: style equalling the tube: capsule nearly 2 lines long (broader than high). — Baker, Journ. Linn. Soc. xi. 436.

In the foothills of the Sierra Nevada, Butte to Amador Counties. Rarely collected; flowering in April.

14. SMILACINA, Desf. False Solomon's Seal.

Perianth persistent, of 6 distinct spreading white 1- (rarely 3-) nerved segments. Stamens 6; filaments subulate, inserted at the base of the segments; anthers rounded or oblong, versatile, introrse. Ovary sessile, ovate, 3-celled: style short and thick, 3-lobed at the summit, persistent: ovules 2 in each cell, usually collateral. Fruit a berry, globose, 1 – 3-seeded. Seeds subglobose, with thin testa and horny albumen. — Stems simple, leafy, from running rootstocks, bearing a terminal raceme or panicle of small flowers with minute bracts; leaves alternate, mostly sessile, oblong or lanceolate, many-nerved; pedicels jointed at the summit. — *Tovaria,* Necker; Baker, Journ. Linn. Soc. xiv. 304.

A genus of 19 species, of eastern Asia and North America from the Arctic Ocean to Guatemala. Seven species are exclusively Asiatic, and as many more belong to Mexico and Central America, while two are common to the northern portions of both continents. Necker's name for the genus is the older and has been adopted by Mr. Baker in his revision; as, however, a genus *Tovaria* had already been established in another order, it seems best, in order to avoid confusion, to retain Desfontaine's familiar name.

* *Flowers panicled, very small: stamens exceeding the oblong-lanceolate perianth-segments.*

1. **S. amplexicaulis,** Nutt. Rootstock stout, elongated: stem 1 to 2½ feet high, covered with a short spreading pubescence or rarely glabrous: leaves ovate to lanceolate, 3 to 7 inches long, strictly sessile and amplexicaul or sometimes with a very short dilated clasping petiole, acute, rounded at base, usually with somewhat of a very short spreading stiff pubescence: panicle sessile or shortly peduncled, oblong, 2 to 6 inches long; pedicels solitary, very short (usually less than a line long): perianth less than a line long: filaments more or less broadly subulate, often broader than the segments: style nearly as long as the ovary: berry light red finely dotted with purple, 2 lines or more in diameter, usually 1-seeded: seed whitish, 1½ lines broad. — Journ. Philad. Acad. vii. 58. *S. racemosa,* var. *amplexicaulis,* Watson, Bot. King Exp. 345. *Tovaria racemosa,* Baker, l. c. 570, in part.

In the Coast Ranges (Monterey County, *Brewer*) and Sierra Nevada to the British boundary, and in the mountains eastward to Utah and New Mexico. It differs from the eastern *S. racemosa* most evidently in its usually sessile leaves more abruptly rounded at base and less distinctly or not at all acuminate, in its much longer style, and considerably smaller seeds. In the Coast Ranges it usually has a larger and broader panicle, the leaves not unfrequently somewhat petiolate and occasionally shortly acuminate. Specimens collected near Oakland (*Sanborn, Brewer*) have softer and longer pubescence, pedicels slender and 1 to 2½ lines long, the stamens twice longer than the perianth, and the ovary narrowed toward the base.

* * *Flowers larger, in a simple few-flowered raceme: stamens shorter than the segments.*

2. **S. sessilifolia,** Nutt. Rootstock slender: stem a foot or two high, usually flexuous above: leaves lanceolate, 2 to 6 inches long, acute or acuminate, sessile and clasping, usually flat and spreading, more or less puberulent: raceme open, sessile or shortly peduncled, the spreading solitary pedicels 2 to 7 lines long: perianth-segments 1½ to 4 lines long, lanceolate, rarely 3-nerved: stamens half as long: style nearly equalling the ovary: berry nearly black, globose, 3 to 5 lines in diameter, 1 – 3-seeded: seeds brown, subovoid, 1½ lines long. — *Tovaria sessilifolia,* Baker, l. c. 566. *S. stellata,* Watson, Bot. King Exp. 345, mainly.

Frequent in the mountains on stream-banks and in damp places, from Monterey County to British Columbia and eastward to the Wahsatch. It has been usually confounded with the following species, which it sometimes closely approaches.

3. **S. stellata,** Desf. Near the last: leaves usually ascending and folded, closely clasping the stem: pedicels of the shorter and more crowded raceme only a

line or two long: segments of the perianth 2 or 3 lines long. — *Tovaria stellata*, Necker; Baker, l. c. 565.

In the Rocky Mountains from British America to New Mexico and eastward to the Atlantic; also apparently on the eastern side of the Sierra Nevada from Klamath Valley (*Cronkhite*) to Carson City, *Anderson*, *Bloomer*.

15. MAIANTHEMUM, Weber. Dwarf Solomon's Seal.

Perianth-segments and stamens 4. Filaments filiform. Ovary 2- (or rarely 3-) celled and stigma 2-lobed. Dwarf, with 2 (rarely 3) ovate- to lanceolate-cordate mostly petioled cauline leaves, and often a single long-petioled leaf from the root. Otherwise as *Smilacina*. Flowers in a usually simple raceme; pedicels solitary or 2 or 3 together.

Only two species, one of which is peculiar to the Atlantic States.

1. **M. bifolium**, DC., var. (?) **dilatatum**, Wood. Glabrous: stem often stout, 3 inches to a foot high, from a slender running rootstock, flexuous above: leaves (2 or 3) ovate- or subreniform-cordate, with a deep sinus and rounded auricles, acute or acuminate, 2 to 4 inches long, on petioles $\frac{1}{2}$ to $2\frac{1}{2}$ inches long, the upper petiole much the shorter; the third leaf, when present, sessile, narrower, usually cuneate at base: raceme pedunculate, $\frac{1}{2}$ to 2 inches long, simple or somewhat paniculate at base; pedicels a line or two long: perianth white, the segments oblong-obovate, 1 to $1\frac{1}{2}$ lines long, becoming deflexed: stamens a third or a half shorter: style stout, shorter than the ovate ovary: berry red, globose, 1–4-seeded, about 3 lines in diameter: seed ovate, brown, over $1\frac{1}{2}$ lines long. — Proc. Philad. Acad. 1868, 174. *Convalloria bifolia*, var. *Kamtschatica*, Cham. & Schlecht. in Linnæa, vi. 587.

Frequent in the Coast Ranges, in swampy places, from Marin County northward to Alaska; also in eastern Siberia and Japan. The ordinary European and Asiatic form differs in its lower and more slender habit, narrower and more attenuate leaves, which with the petioles are more or less pubescent, and a more slender style; the flowers, fruit, and seeds are also somewhat smaller.

16. NOLINA, Michx.

Flowers polygamo-dicœcious, small. Perianth persistent, of 6 distinct whitish oblong-lanceolate 1-nerved segments. Stamens 6, included, near the base of the segments, mostly abortive or wanting in the fertile flowers; filaments very short, filiform; anthers cordate-ovate, versatile, introrse. Ovary sessile, deeply 3-lobed, rudimentary in the sterile flowers; ovules 2 at the base of each cell; styles very short, distinct and recurved or slightly coherent, stigmatic on the inner side. Capsule mostly membranaceous and somewhat inflated, subglobose, lobed nearly to the middle, loculicidal or the thin walls usually bursting irregularly and often before the maturity of the seed. Seeds solitary, globose to ovate-oblong, with a close thin light-colored slightly wrinkled or reticulated testa. — Perennials, with a thick woody caudex or trunk (often elongated with a much dilated base), numerous narrowly linear and mostly rigid serrulately margined leaves, and a stout nearly naked flowering stem bearing a compound racemose many-flowered panicle, the main branches subtended by foliaceous long-attenuate bracts; pedicels solitary, short, jointed usually near the base, subtended by minute scarious bracts. — Watson, Proc. Amer. Acad. xiv. 246. *Beaucarnea*, Lemaire; Baker, Trim. Journ. Bot. x. 323.

A genus of about a dozen species, of Mexico and the southern borders of the United States, many of them only imperfectly known.

* *Fruit inflated, the cells not burst by the maturing seed.*

1. **N. Bigelovii,** Watson, l. c. Leaves flat, nearly an inch wide above the broad deltoid base, not carinate, 3 or 4 feet long, the margin roughish: "scape 3 feet high": branchlets of the compound panicle slender, an inch or two long: perianth-segments a line long: fruiting pedicels very slender, 2 to 4 lines long, jointed near the middle: fruit very thin, 4 or 5 lines in diameter, deeply emarginate at both ends: seeds ovate-oblong, 2 lines long, whitish, slightly reticulated. — *Dasylirion Bigelovii,* Torr. Pacif. R. Rep. iv. 151. *Beaucarnea Bigelovii,* Baker, l. c. 326.

On mountain-sides above Williams River in W. Arizona, and likely to occur in the mountains of San Bernardino County bordering the Colorado Desert. The characters of the caudex and flowering stem are unknown.

2. **N. Parryi,** Watson, l. c. Caudex 3 to 6 feet high: leaves resembling those of the last species, but thicker and somewhat concave above, especially toward the stout apex, very strongly serrulate on the margin: branchlets of the panicle and the pedicels stouter: perianth-segments 1½ lines long: fruit 6 lines in diameter, rather more thickly membranous: seeds subglobose, the very thin transparent testa finely and irregularly wrinkled.

On the western border of San Bernardino Desert, *Dr. C. C. Parry,* 1876.

* * *Fruit smaller and soon bursting, leaving the globose seeds exposed.*

3. **N. Palmeri,** Watson, l. c. Leaves as in the preceding, flat, very strongly serrulate: flowering stem smooth and glabrous: panicle very narrow, 3 feet long, the partial panicles pyramidal, only 3 inches long or less, and the branchlets an inch long; primary bracts large and dilated: pedicels 2 lines long: flowers very small, the segments less than a line long: stigmas upon a short style: fruit 2 lines broad before rupture: seeds globose, with very thin transparent smoothish testa.

Near the southern border, in the Tantillas Mountains, Lower California, *Dr. E. Palmer,* 1875.

17. YUCCA, Linn. Spanish Bayonet.

Perianth large and campanulate, or spreading, of 6 white or whitish somewhat persistent ovate-lanceolate many-nerved segments woolly at the apex. Stamens included, adnate to the base of the segments; filaments clavate, often papillose; anthers short, oblong, sagittate or didymous, versatile, introrse. Ovary sessile, oblong or subglobose; stigmas 3, emarginate and more or less connate, sessile or on a stout tubular persistent style. Fruit more or less fleshy and baccate, or a dry and septicidal or loculicidal capsule, the cells incompletely divided by a partition intruded from the back. Seeds numerous, in 2 rows in each cell, flat, horizontal, with thin black testa. Embryo diagonal, straight or curved. — Caudex woody, soft and fibrous, simple or branched, very short or becoming tall and palm-like, bearing the sessile or pedunculate inflorescence or often a tall bracteate flowering stem; leaves numerous, crowded, thick and rigid, persistent, linear or narrowly lanceolate, usually spine-tipped, with smooth or serrulate or filamentose margins; flowers in an ample compound panicle, usually solitary and nodding, opening at evening; pedicels jointed near the summit. — Engelmann, Trans. St. Louis Acad. iii. 17.

An American genus of a dozen or more species, most abundant in the southern United States and northern Mexico, one species ranging northward to Dakota and two or more belonging to Guatemala.

* *Perianth campanulate: filaments obtuse, papillose, at length spreading or recurved; anthers cordate-sagittate: stigmas papillose, more or less distinct: fruit mostly fleshy and indehiscent.* — Euyucca, Engelm.

+ *Fruit baccate: seeds thick, undulate, with ruminate albumen: leaves filamentose.*

1. **Y. baccata,** Torr. Stoloniferous: caudex usually short, covered with the refracted dead leaves, or none: leaves narrowly lanceolate, contracted above the dilated base, 1 to 3 feet long and an inch or two wide, thick, very rigid and usually scabrous, concave and often deeply so, terminating in a very stout brownish spine, the margin at length bearing coarse recurved threads: panicle pedunculate, pyramidal, mostly smooth: lower bracts ovate-lanceolate, pungent, somewhat coriaceous, whitish within, the upper narrower: flowers usually large, the segments of the perianth 1 to 3 inches long and 6 to 12 lines wide: stamens 6 to 9 lines long: ovary oblong, prismatic, an inch or two long including the slender more or less elongated style: fruit pendulous, baccate, dark purple, ovate to cylindrical, 2 to 5 inches long, beaked: seeds often very large (4 to 8 lines broad) and thick. — Bot. Mex. Bound. 221; Engelm. Bot. King Exp. 496, and l. c. 44; Ill. Hort. 3 ser. t. 115. *Y. filamentosa ?,* Wood, Proc. Philad. Acad. 1868, 167.

From Monterey to San Diego, ranging to S. Utah, W. Texas and Northern Mexico. A variable species, the more northern form often acaulescent, but southward becoming 8 to 10 feet high or more. The fruit is sweet and edible; flowering from March to June, according to latitude.

+ + *Fruit becoming dry and spongy: seeds thickish, smooth, with entire albumen: leaves serrulate.*

2. **Y. brevifolia,** Engelm. Caudex erect, tall (15 to 30 feet high, often a foot or two in diameter), with rough cracked bark, branched above: leaves short (usually 6 to 8 inches long and 3 to 6 lines wide), very rough and rigid, linear from a broad base, attenuate into a sharp stout spine, somewhat convex above, the margin very rough with small stout teeth: flowers fetid, erect, crowded in a sessile ovate panicle: bracts ovate to lanceolate, white and scarious-margined, nearly equalling the flowers: pedicels very short: segments of the narrowly campanulate perianth greenish-white, narrowly lanceolate, 1½ to 2½ inches long: stamens 4 or 5 lines long, about half the length of the oblong-pyramidal ovary: stigmas short and nearly sessile: fruit erect, ovate, 2 or 3 inches long (1½ inches thick or more), slightly 6-angled, somewhat pointed, with thick spongy pericarp. — Bot. King Exp. 496, and l. c. 47 & 213. *Y. Draconis,* var. (*l*) *arborescens,* Torr. Pacif. R. Rep. iv. 147.

In the desert region of San Bernardino County, and eastward to Southern Utah and Northwestern Arizona, often abundant and even forming "straggling forests."

* * *Perianth rotate-spreading: filaments acutish, smooth, erect; anthers didymous, transverse: stigma hairy-papillose, peltate: fruit a loculicidal capsule: seeds thin, smooth, with entire albumen: acaulescent, with serrulate leaves and tall bracteate scape.* — HESPEROYUCCA, Engelm.

3. **Y. Whipplei,** Torr. Stoloniferous; caudex none or very short: leaves glaucous-green, rigid, linear-subulate from a broad base, 10 to 20 inches long and 4 to 7 lines wide, attenuate to a sharp triangular brown spine, nearly flat, deeply concave near the apex; margin finely serrulate: scape 4 to 12 feet high, beset with broad sheathing and imbricated foliaceous pungent bracts 6 to 9 inches long: panicle narrow and spike-like, dense, smooth; lower bracts large and foliaceous, the upper small and scarious, much shorter than the slender pedicels which are conspicuously jointed at or above the middle (½ to 2 inches long); segments of the greenish-white pendulous perianth spreading horizontally, 1 to 2 inches long, oblong-lanceolate or somewhat spatulate: stamens spreading, 4 to 7 lines long, equalling or longer than the oblong deeply lobed ovary: style short, conical, bearing the green capitate-peltate slightly 3-lobed stigma: capsule globose-obovate, an inch long or more; valves remaining entire after dehiscence and seeds escaping at either end of the false partition. — Bot. Mex. Bound. 222; Engelm. Bot. King Exp. 497, and l. c. 54; Baker, Gard. Chronicle, n. ser. vi. 196, fig. 42. *Y. aloifolia,* Torr. Pacif. R. Rep. iv. 147.

On dry rocky hills from Monterey to San Diego and eastward into Arizona. *Y. graminifolia*, Wood, l. c., from the mountains east of Los Angeles, appears to be a form or variety with longer and narrower leaves (20 inches by 3 lines), laxer and more deeply channelled, revolute toward the apex and terminated by a more slender spine: pod 18 lines long, transversely rugose.

18. LILIUM, Linn. Lily.

Perianth deciduous, funnelform, of 6 distinct equal oblanceolate spreading or recurved segments, with a nectariferous groove toward the base, net-veined, white, yellow, or red, often spotted with brown. Stamens 6, hypogynous, included; filaments elongated; anthers linear to oblong, versatile, extrorse, dehiscent laterally. Ovary sessile, many-ovuled; style long, clavate, deciduous; stigma 3-lobed. Capsule coriaceous, loculicidal, erect, somewhat 6-angled. Seeds numerous, flat, horizontal, in 2 rows in each cell, with brownish thin testa. — Stems leafy, simple, from scaly bulbs; leaves narrow, sessile, whorled or scattered, net-veined; flowers large and showy, solitary or racemose or subumbellate; pedicels not jointed, with foliaceous bracts. — Baker, Journ. Linn. Soc. xiv. 225; Watson, Proc. Amer. Acad. xiv. 255.

A genus of nearly 50 species, of the northern temperate zone, extensively cultivated for their showy and often fragrant flowers. More than half are natives of Eastern Asia, and 4 or 5 species are found in the Atlantic States. The Californian species have lately been introduced into European gardens, and some of them are very handsome.

* *Flowers spotless or only finely dotted, white or purplish or pale yellow, the spreading segments with long narrow claws.*

† *Flowers horizontal, large.*

1. **L. Washingtonianum**, Kell. Bulbs large, somewhat rhizomatous and oblique (becoming 6 or 8 inches long), the thin imbricated lanceolate scales 2 or 3 inches long and not jointed: stems terete, 2 to 5 feet high, glabrous or slightly scabrous: leaves in several whorls of 6 to 12 (the upper and lower usually scattered), oblanceolate, acute or acutish, 2 to 5 inches long and 8 to 12 lines wide, more or less undulate: flowers very fragrant, pure white becoming purplish, or often sparingly and finely dotted, 2 to 20 or more in a thyrsoid raceme, horizontally declinate on stout nearly erect pedicels 1 to 4 inches long; segments 3 or 4 inches long and 4 to 8 lines wide, the upper third spreading: stamens a little shorter, with yellow anthers 5 or 6 lines long: ovary 7 to 10 lines long: capsule obovate-oblong, truncate, obtusely 6-angled or sometimes narrowly winged, 15 lines long or more. — Proc. Calif. Acad. ii. 13; also independently by Wood, Proc. Philad. Acad. 1868, 166; Regel, Gartenfl. t. 710; Fl. Serres, t. 1795.

In the Cuyumaca Mountains, San Diego County (*Palmer*), and on the western slope of the Sierra Nevada at an altitude of 3,000 to 6,000 feet, northward to the Columbia River. A beautiful species, growing in loose soil on ridges or lightly shaded hillsides.

2. **L. Parryi**, Watson. Bulb small, somewhat rhizomatous, of numerous thick jointed scales about an inch long: stem slender, glabrous, 2 to 5 feet high, 2–10-flowered: leaves usually scattered, sometimes the lower in a whorl, linear-oblanceolate, 4 to 6 inches long by about half an inch wide, mostly acuminate: flowers pale yellow, sparingly and minutely dotted, on stout pedicels about an inch long; segments 3 inches long or more, 5 or 6 lines wide, somewhat spreading above or the tips at length recurved: stamens and style a little shorter; anthers oblong, brownish, 3 lines long: capsule narrowly oblong, acutish, nearly 2 inches long by 6 lines in breadth. — Proc. Davenport Acad. ii. 188, t. 5, 6, and l. c. 256.

In a marsh in San Gorgonio Pass, in the Coast Ranges of San Bernardino County; first collected by *Dr. C. C. Parry* in July, 1876, in flower.

+ + Flowers erect or ascending, smaller.

3. **L. rubescens,** Watson. Bulb as in *L. Washingtonianum,* but much smaller (about 2 inches in diameter), the thick broadly lanceolate scales an inch long: stem usually stout, 1 to 7 feet high, smooth: leaves glabrous, glaucous beneath, undulate or flat, the lower scattered, the upper in 3 to 7 whorls, oblanceolate, acute or acutish, 1 to 4 inches long and 6 to 12 lines wide: flowers usually several, on ascending pedicels 1 to 3 inches long, pale lilac or nearly white, becoming rose-purple, somewhat dotted with brown; segments 1½ or 2 inches long, the upper third revolute: stamens and style a third shorter; anthers 2 or 3 lines long: ovary wing-angled, attenuate downward, half an inch long. — Proc. Amer. Acad. xiv. 256. *L. Washingtonianum,* var. *purpureum,* Masters, Gard. Chron. 2 ser. ii. 322, fig. 67; Elwes, same, vi. 242; Baker, l. c. 233.

On wooded hillsides in the Coast Ranges, from Marin (*Bolander*) to Humboldt Counties, *Rattan.*

** * Flowers orange-yellow or reddish, mostly conspicuously spotted: segments oblanceolate.*

+ Flowers erect or horizontal, small.

4. **L. parvum,** Kell. Bulbs small, of short thick jointed scales a half-inch to an inch long, upon a branching rhizome: stem slender, 1½ to 6 feet high or more: leaves scattered or in whorls, 2 to 5 inches long and an inch broad or less, sometimes linear, acute or acuminate: flowers 2 to very many (30 to 50), erect or nearly so on slender suberect pedicels 2 to 4 inches long, scattered or somewhat verticillate, yellow or orange within and usually spotted with purple, reddish above; segments narrowly oblanceolate, 1 to 1½ inches long, more or less spreading or the tips recurved, pubescent toward the apex: stamens an inch long, nearly or quite equalling the style; anthers oblong, 1 or 2 lines long: capsule subspherical, 6 to 9 lines long, truncate above. — Proc. Calif. Acad. ii. 179, fig. 12; Regel, Gartenfl. 1872, 163, t. 725; Elwes, Monogr. Lil. t. 24. *L. Canadense,* var. *Walkeri,* Wood, l. c. 166. *L. Canadense,* var. *parvum,* Baker, l. c. 241; Hook. f. Bot. Mag. t. 6146.

In the Sierra Nevada at an elevation of 4,000 to 8,000 feet, and northward into Oregon. Distinguished from *L. Columbianum* by the different bulb, and by the smaller less nodding flowers, their segments less recurved.

5. **L. maritimum,** Kell. Bulb conical, 1 to 1½ inches in diameter, with close-pressed scales: stem a foot or two high or more, slender: leaves scattered or very rarely somewhat verticillate, narrowly oblanceolate or linear, 1 to 5 inches long and 3 to 6 lines wide, obtuse: flowers 1 to 5, on long peduncles, horizontal, deep reddish orange, spotted within with purple; segments lanceolate, 15 to 18 lines long, the upper third somewhat recurved: stamens scarcely an inch long, exceeding the style, with oblong anthers 2 lines long: "capsules long and narrow." — Proc. Calif. Acad. vi. 140. *L. Canadense,* var. *parviflorum,* Bolander, same, v. 206.

Near the coast, in low black peaty meadows, from San Francisco to Humboldt County (*Kellogg & Harford,* n. 997); Albion and Noyo swamps (*Bolander,* n. 4827, 6557); flowering from May to August. According to Bolander, it grows when in sheltered situations to a height of 3 to 5 feet, bearing numerous flowers.

+ + Flowers nodding, larger, with revolute segments.

++ Bulbs rhizomatous.

6. **L. pardalinum,** Kellogg. Rhizomes thick and branching, forming mat-like masses of roundish oblate bulbs, the scales jointed near the base: stems 3 to 7 feet high: leaves usually in 3 or 4 whorls of 9 to 15, scattered above and below, narrowly lanceolate and sharply acuminate, 3 to 7 inches long and 9 to 12 lines broad, deep green, thin and faintly 3-nerved, glabrous and glaucous, as also the stem: flowers few to many, racemose or the lower in whorls, on long spreading pedicels; segments 2 or 3 inches long and 6 to 9 lines wide, lanceolate, strongly revolute,

bright orange-red with a lighter orange centre and large purple spots on the lower half: stamens and style a third shorter; anthers red, 4 or 5 lines long: ovary 12 to 14 lines long: capsule narrowly oblong with acutish angles, 1½ inches long or more, umbilicate at the summit. — Proc. Calif. Acad. ii. 12; Baker, l. c. 242. *L. Californicum*, Lindl.; Florist, 1873, t. 33. *L. superbum*, var. *pardalinum*, Baker, Journ. Hort. Soc. 1873, 45. *L. Canadense*, vars. *pardalinum* and *Californicum*, Bolander, l. c.

Var. **angustifolium**, Kell. Stem slender, 2 or 3 feet high: leaves scattered or somewhat verticillate, linear (3 or 4 lines broad), obscurely 3–5-nerved: flowers 1 to 10, with narrow segments. — Watson, l. c. 258. *L. Canadense*, var. *Hartwegi*, Baker. *L. Roezli*, Regel, Gartenfl. 1870, t. 667; Baker, l. c. 243.

From Central California probably to Oregon, in the Coast Ranges and foothills of the Sierra Nevada to an altitude of 4,000 feet, on stream-banks and in wet localities; the variety on moist slopes in the lower foothills. Roezl's reported locality for the variety (mountains of Utah) was doubtless a mistake. It has also been found in the Santa Cruz Mountains (*Hartweg*) and in Humboldt County, *Kellogg*.

++ ++ *Bulbs ovoid, with fleshy lanceolate imbricated scales.*

7. **L. Humboldtii**, Roezl & Leichtlin. Bulbs large, 2 to 6 inches in diameter, white or purplish, the very fleshy ovate-lanceolate acute scales 2 or 3 inches long: stems stout, purplish, puberulent or glabrous, 4 to 8 feet high: leaves usually in 4 to 6 whorls of 10 to 20 each, oblanceolate, undulate, 4 or 5 inches long and 9 to 12 lines wide, acute, bright green, somewhat scabrous or pubescent on the margin and beneath: bracts often ovate: flowers few to many, on usually stout and widely spreading pedicels 3 to 6 inches long or more, scattered; segments 3 or 4 inches long, 6 to 12 lines broad, strongly revolute above the short abruptly narrowed claw, reddish orange with purple spots, papillose-ridged toward the base: stamens 1½ to 2 inches long, about equalling the style, with red oblong-linear anthers 4 to 8 lines long: capsule large, obovoid, acutely 6-angled. — Duchartre, Obs. 105; Regel, Gartenfl. 1872, t. 724; Fl. Serres, t. 1973; Krelage, Not. de Lis, 27, t. 4. *L. Canadense*, var. *puberulum*, Torr. Pacif. R. Rep. iv. 146. *L. Bloomerianum*, Kellogg, Proc. Calif. Acad. iv. 160, and var. *ocellatum*, same, v. 88, t. 4.

In dry open localities in the foothills of the Sierra Nevada at 2,500 to 3,500 feet altitude, southward to San Diego County (*Palmer*) and Santa Rosa Island off Santa Barbara, *Harford*.

8. **L. Columbianum**, Hanson. Bulb small (1½ to 2 inches in diameter), with lanceolate acute closely appressed whitish scales: stems 2 or 3 feet high or more, slender: leaves in whorls of 5 to 9 or sometimes more, the upper and lower scattered, oblanceolate, 2 to 4 inches long and 6 to 15 lines wide, acute, smooth: flowers few to many, scattered, on slender curving more or less divergent pedicels 3 to 6 inches long; segments 1½ to 2 inches long and 4 to 6 lines wide, strongly revolute, bright reddish orange thickly spotted with purple: stamens about equalling the style, 12 to 15 lines long, with yellow oblong anthers 2 or 3 lines long: capsule short-oblong, an inch long, acutely 6-angled. — Baker, Gard. Chron. 1871, 1257, and l. c. 243. *L. Canadense*, var. *parviflorum*, Hook. Fl. Bor.-Am. ii. 181. *L. Canadense*, vars., Wood, l. c. 166. *L. lucidum*, Kellogg, l. c. vi. 144.

Frequent in Washington Territory and Oregon, and southward in the Sierra Nevada to Plumas and Sierra Counties.

19. FRITILLARIA, Linn.

Perianth campanulate to funnelform, deciduous, of 6 distinct equal oblong-oblanceolate concave segments, somewhat spreading, more or less blotched or tinged with purple, or sometimes yellow or white, and with a smooth shallow nectariferous pit near the base. Stamens 6, inserted on the base of the segments, included; filaments slender; anthers oblong, versatile, extrorse, dehiscing laterally. Ovary sessile or

nearly so, many-ovuled: styles slender, usually exceeding the stamens, united to the middle or throughout, deciduous. Capsule membranaceous, broadly obovate or shortly oblong, obtusely or acutely 6-angled or 6-winged, loculicidally 3-valved. Seeds numerous, horizontal, flat, in 2 rows in each cell, with thin light brownish testa. — Stems erect, simple, leafy, from scaly bulbs; leaves scattered or verticillate, narrow, sessile; flowers solitary or racemose, leafy-bracteate, mostly dull-colored, nodding: bulbs (in our species) of very thick fleshy scales, small, the scales usually terminating in a scarious appendage, sometimes 1 or 2 of them leaf-bearing in early spring, occasionally surrounded by thin membranous coats. — Baker, Journ. Linn. Soc. xiv. 251. *Amblirion*, Raf. *Liliorhiza*, Kellogg.

A genus of over 50 species, distributed throughout the northern temperate zone, but in America confined to the Pacific coast. About 30 species are Asiatic, and half as many are European. One only of the following American species is also Siberian. Some are very ornamental and have long been familiar in gardens, and most of the Californian species are worthy of cultivation.

* *Styles distinct above; stigmas linear.*

+ *Capsules rather obtusely angled: flowers mostly large (an inch long).* — Liliorhiza, Baker.

1. **F. recurva**, Benth. Bulb of numerous thick scales 3 or 4 lines long or less: stem rather stout, 8 to 18 inches high, 1–9-flowered: leaves linear-lanceolate, usually 8 to 12, mostly in 2 whorls near the middle of the stem, 3 or 4 inches long: flowers described as scarlet outside and yellow spotted with scarlet within, though dried specimens appear thickly blotched and tinged with light reddish purple or scarlet; segments narrowly oblanceolate, with tips usually recurved, 12 to 18 lines long; nectary obscure: stamens a little shorter, equalling the very slender styles; anthers nearly 2 lines long. — Pl. Hartw. 340; Baker, l. c. 272, and Bot. Mag. t. 6264.

In the Sierra Nevada, from Placer County northward into Oregon. The figure cited does not represent the ordinary form of the species, either in the scarlet and yellow colors of the small flowers or in the stout obscurely 3-lobed style.

2. **F. liliacea**, Lindl. Bulbs of few very thick scales 3 or 4 lines long: stem slender, 6 to 12 inches high, 1–5-flowered: leaves 5 to 10, usually approximate or verticillate near the base, oblanceolate to linear, 1½ to 3 inches long: flowers greenish white, not blotched; segments rather broadly oblanceolate, spreading, 8 to 12 lines long: stamens 4 lines long, shorter than the stout style; anthers 1 to 1½ lines long, oblong, mucronate: capsule distinctly stipitate, half an inch long and broad, truncate at each end. — Bot. Reg. xx, under t. 1663; Baker, l. c. 273. *F. alba*, Kellogg, Proc. Calif. Acad. i. 46. *Liliorhiza lanceolata*, Kellogg, same, ii. 46, fig. 1; Regel, Gartenfl. 1871, t. 715.

About San Francisco, and probably throughout the lower Sacramento Valley.

3. **F. biflora**, Lindl. l. c. Bulb of a few very thick and fleshy ovate scales, 3 to 5 lines long, often tipped with a small ovate scarious blade: stem usually stout, 6 to 18 inches high, 1–3-flowered: leaves 2 to 6, mostly near the base, scattered or somewhat verticillate, lanceolate or oblong-lanceolate or sometimes linear, 2 to 4 inches long: flowers dark brownish purple tinged with green; segments widely spreading, oblong-oblanceolate, about an inch long, with obscure nectaries: stamens 4 or 5 lines long with mucronate anthers 2 lines long: style stout: capsule broadly obovoid and somewhat 6-angled, 6 to 9 lines long. — Baker, l. c. *F. Kamtschatcensis*, Torr. Pacif. R. Rep. iv. 146. *F. lanceolata*, Torr. Bot. Mex. Bound. t. 61. *F. Grayana*, Reichenb. f. & Baker, Trim. Journ. Bot. 2 ser. vii. 262.

In the Coast Ranges from San Diego to Mendocino County. Flowering at San Diego in February and abundant there in stony places.

+– +– *Capsule short and thick, acutely angled or winged.* — Goniocarpa, Baker.

++ *Flowers usually large (an inch long or more).*

4. **F. lanceolata,** Pursh. Bulbs of thick scales half an inch long or less: stem a foot or two high, 1–2-flowered, deep green and glaucous throughout: leaves usually 6 to 12, in 1 to 3 whorls on the upper part of the stem, linear-lanceolate to lanceolate, 2 to 5 inches long: flowers on slender pedicels (at least the lower ones an inch long or more), broadly campanulate, dark purple somewhat mottled with greenish yellow; segments narrowly oblong-lanceolate, strongly arched, with a large oblong nectary: stamens 6 to 8 lines long; anthers 1½ to 3½ lines long: capsule broadly winged, nearly an inch long. — Hook. Fl. Bor.-Am. ii. 181, t. 193, B.

Var. **floribunda,** Benth. Flowers several (1 to 8), usually lighter colored, coarsely blotched with brownish purple; segments broad (4 to 6 lines), acute, the margin finely crenulate-undulate. — Pl. Hartw. 338. *F. mutica,* Lindl. l. c.

Var. **gracilis,** Watson. Flowers smaller than in the last, with narrower and more acuminate segments: filaments short and anthers often scarcely longer than broad. — Proc. Am. Acad. xiv. 259. *F. lanceolata,* var. (?), Benth. Pl. Hartw. 340.

The typical form ranges from British Columbia southward near the coast into Northern California (Mendocino County, *Bolander,* n. 4707). The varieties are common in the Coast Ranges from Santa Cruz to Marin Counties, the var. *gracilis* the less frequently (Corte Madera, *Hartweg,* n. 2005; near the Geysers, *Bolander,* n. 3969; also by *Bridges,* n. 350; at Camp Bidwell, *Matthews,* and near Chico, with very dark flowers, *Mrs. J. Bidwell*). The *F. viridia* of Kellogg, Proc. Calif. Acad. ii. 9, from near New Idria, appears to be a form with light-colored unmottled flowers. The radical leaves are sometimes very large, ovate or elliptical.

++ ++ *Flowers smaller: leaves linear.*

5. **F. parviflora,** Torr. Bulb as in the last: light green, not glaucous or the slender stem slightly so, 18 inches high, 3–20-flowered: leaves narrowly linear-lanceolate, 6 to 15, more or less verticillate, 3 or 4 inches long: flowers on short (6 lines long or less) and strongly recurved pedicels, yellowish with more or less of purplish brown; segments concave, oblanceolate, spreading, 6 to 8 lines long, with shallow nectaries: stamens 4 or 5 lines long; anthers oblong, unequal, 1½ to 3 lines long: capsule 6-winged. — Pacif. R. Rep. iv. 146. *F. multiflora,* Kell. l. c., i. 57, apparently.

Near Murphys, Calaveras County (*Bigelow*); Big Tree Grove, *Torrey, Brewer.* Distinguished from the last by its more numerous smaller and lighter-colored flowers on shorter pedicels, the segments less arched.

6. **F. atropurpurea,** Nutt. Bulb of numerous thick scales, half an inch long or less: stem usually slender, 8 to 15 inches high or more, 1–6-flowered: leaves 6 to 20, scattered on the upper part of the stem or somewhat verticillate, 2 or 3 inches long: flowers on slender pedicels, dull purple with more or less of yellowish green; segments 5 to 9 lines long, spreading, with obscure nectaries: stamens about 4 lines long; anthers 1½ to 2 lines long: style slender: capsule acutely angled, broadly obovate. — Journ. Acad. Philad. vii. 54.

In the Sierra Nevada from Placer County to the Columbia, and eastward to the Wahsatch.

* * *Styles connate and stigma shortly 3-lobed: flowers not spotted: capsule obtusely angled.*

7. **F. pluriflora,** Torr. Bulb of large thick scales, a half-inch to an inch long: stem stout, a foot high or more, 4–12-flowered: leaves 8 to 15, nearly covering the stem, somewhat verticillate, narrowly lanceolate, 3 or 4 inches long: flowers nodding on long pedicels, uniformly reddish purple; segments somewhat spreading, 9 to 12 lines long, oblanceolate; nectaries obscure: stamens unequal, 6 or 7 lines long, shorter than the style; anthers 2 lines long. — Benth. Pl. Hartw. 338; Baker, l. c. 270.

On the Upper Sacramento (*Hartweg*), and on the Feather River, *Fremont.* Peculiar in the size of its bulb.

8. **F. pudica,** Sprengel. Bulb of numerous very small rounded scales: stem 3 to 8 inches high, 1–6-flowered: leaves 3 to 8, linear to narrowly oblanceolate, scattered or somewhat verticillate, 2 to 4 inches long: flowers usually solitary, nodding, yellow or orange and tinged with purple, with very obscure nectaries; segments 5 to 9 lines long, oblong-spatulate, obtuse, somewhat spreading: stamens nearly equalling the style, 6 to 8 lines long; anthers 2 lines long: capsule oblong to subglobose, 6 to 12 lines long. — Syst. ii. 64. *Lilium pudicum,* Pursh, Flora, 228, t. 8. *Amblirion pudicum,* Raf.; Torr. in Stansb. Rep. 396, t. 9. *Theresia pudica,* Klatt.

In the mountains from Carson City to British Columbia and eastward to Montana and Utah. Flowering in early spring.

20. ERYTHRONIUM, Linn.

Perianth broadly funnelform, deciduous, of 6 distinct nearly equal lanceolate segments, mostly strongly recurved from near the base, yellow (varying to white or purplish), the inner usually auriculate below and callous-toothed on each side of a nectariferous groove. Stamens 6, hypogynous, with rather short slender filaments, and linear anthers attached by the base and laterally dehiscent. Ovary nearly sessile, many-ovuled: style slender, entire with short 3-lobed stigma, or 3-cleft and the linear stigmas at length revolute, deciduous. Capsule membranaceous, obtusely triangular, loculicidally 3-valved. Seeds oblong-obovate, ascending in 2 rows in each cell, with brown rugulose testa somewhat loose at the apex. — Stem simple, low, lax, from an oblong membranous-coated corm, bearing near the base a pair of closely approximate flat dilated net-veined leaves; flowers showy, solitary or few in a naked raceme or rarely subumbellate. — Baker, Journ. Linn. Soc. xiv. 296.

An American genus, with the exception of a single species which ranges through Europe and Asia. Three other species are found in the Atlantic States.

1. **E. grandiflorum,** Pursh. Corm narrow, often 2 inches long: leaves not mottled, always closely approximate, oblong-lanceolate, acute or acutish and with broad and usually short petioles, 3 to 6 inches long by one or two wide: flowers solitary or often in a raceme of 2 to 6 or more, yellow or cream-color with a more or less orange base; segments lanceolate and somewhat acuminate, strongly recurved, 1 to 2 inches long: filaments long and slender; anthers 3 to 5 lines long: ovary and capsule narrowly oblong, narrowing to a short stipe; capsule an inch long or more. — Lindl. Bot. Reg. t. 1786; Regel, Gartenfl. 1876, t. 874, fig. 6.

Var. (?) **Smithii,** Hook. Flowers large, tinged with purple or rose-color: filaments often short and broadly dilated: ovary broader and more obtuse. — Fl. Bor.-Am. ii. 182. *E. revolutum,* Smith, Rees Cyc. *E. grandiflorum,* var. *revolutum,* Baker, l. c.

The various forms referred to this species are imperfectly known and need investigation. The typical form, common in Washington Territory and Oregon, appears also to be found in Northern California. The purplish variety, collected in the redwoods of Mendocino (*Bolander,* n. 4709), is probably identical with the form of the plant described by Smith and first discovered by Menzies at Vancouver Island, and may prove distinct. A variety with smaller flowers than the type, but apparently otherwise the same (var. *minor,* Morren, Belg. Hort. 1876, 109, t. 6), is common in the mountains of Utah and Colorado and northward. What is called var. *albiflorum,* Hook. (Regel, Gartenfl. 1874, t. 767, and figured as *E. giganteum* in Bot. Mag. t. 5714), of Washington Territory, is described as having mottled leaves and very large white flowers with a yellow and orange base. The fruit and bulbs as well as the fresh flowers of these varieties need to be compared.

2. **E. Hartwegi,** Watson. Bulb small (6 to 8 lines long), ovate-oblong: leaves often more or less distant, apparently mottled, oblanceolate: flowers solitary, or 2 or 3 in a sessile umbel, light yellow and orange; the lanceolate acuminate segments

an inch or two long, spreading or scarcely recurved: filaments rather short, slender; anthers 2 to 4 lines long: ovary ovate-oblong, 2 or 3 lines long. — Proc. Amer. Acad. xiv. 261. *E. grandiflorum*, Benth. Pl. Hartw. 339.

In the Sierra Nevada; Butte County (*Hartweg*); Chico (*Mrs. J. Bidwell*); near Auburn (*Bolander*, n. 4527); Plumas County (*Mrs. Ames*); also found by *Bridges* (n. 332). The capsule and seeds are unknown.

3. **E. purpurascens,** Watson. Bulb narrowly oblong, an inch or two long: leaves undulate, oblong- to narrowly lanceolate, 4 to 6 inches long and ½ to 2 inches wide, acute or acutish and narrowed to a very broad and short petiole: peduncle stout and occasionally divided, racemosely or somewhat umbellately 4–8-flowered or more; pedicels very unequal, the upper becoming 2 to 6 inches long: flowers light yellow more or less tinged with purple, deep orange at base; segments lanceolate, 9 to 12 lines long: stamens 4 or 5 lines long, equalling the clavate style; anthers oblong-linear, 1 or 2 lines long: capsule narrow, 12 to 15 lines long: seeds about 2 lines long. — Proc. Am. Acad. xii. 277. *E. grandiflorum*, var. *multiflorum*, Torr. Pacif. R. Rep. iv. 146. *Fritillaria multiscapidea*, Kellogg, Proc. Calif. Acad. i. 46.

Var. **uniflorum.** Peduncles slender, 1-flowered. — *E. grandiflorum*, Torr. Pacif. R. Rep. iv. 146. *E. revolutum*, Baker, Gard. Chron. 2 ser. v. 138.

In the Sierra Nevada, from Placer to Plumas County; a clearly marked species.

21. CALOCHORTUS, Pursh.

Perianth deciduous, of 6 distinct more or less concave segments, the 3 outer (*sepals*) lanceolate, greenish and more or less sepaloid, the inner (*petals*) mostly broadly cuneate-obovate, usually with a conspicuous glandular pit near the base, and very variously colored. Stamens 6, on the base of the segments, included; anthers linear to oblong, basifixed, dehiscent laterally. Ovary sessile, triquetrous and 3-celled, many-ovuled: stigmas sessile, recurved, persistent. Capsule elliptical to oblong, membranaceous, 3-angled or 3-winged, mostly septicidally dehiscent. Seeds numerous, in 2 rows in each cell, somewhat flattened, with a thin membranous white or brownish often loose testa. — Stems usually flexuous and branching, from membranous- or rarely fibrous-coated corms; leaves few, linear-lanceolate, radical and cauline, the latter alternate and clasping, all with many nerves and transverse veinlets; flowers few, showy, terminal on the branches or umbellately fascicled. — Baker, Journ. Linn. Soc. xiv. 302; Watson, Proc. Amer. Acad. xiv. 262.

A genus confined to Western America, ranging from British Columbia to Mexico and from the Pacific to the Rocky Mountains. The half-dozen Mexican species are somewhat peculiar and form a distinct section. The whole genus is unique, in some of its characters allied to the Tulip of the Old World, in others to the Melanthaceous group of genera. The colors of the flowers are in some of the species very variable.

* Flowers or fruit nodding: petals incurved or strongly arched; gland transversely crested or hairy: capsule with broad thin acute or winged cells.

Flowers subglobose, nodding.
- Petals white, bearded and ciliate. — 1. C. ALBUS.
- Petals yellow, very deeply pitted: anthers obtuse. — 2. C. PULCHELLUS.

Flowers campanulate, the petals less arched.
- Pedicels slender, nodding in fruit: flowers small.
  - Flowers yellow: pit shallow: anthers acute. — 3. C. BENTHAMI.
  - Flowers white or lilac, mostly umbellate.
    - Petals covered with hairs and ciliate.
      - Low: petals white or purplish; claw with a transverse scale: anthers acuminate: bracts over an inch long. Coast Ranges. — 4. C. MAWEANUS.
      - Low: petals lilac; scale fringed: anthers obtuse: bracts shorter: capsule suborbicular, obtuse. Sierra Nevada. — 5. C. CÆRULEUS.

Low: petals white; gland with a transverse fringe of ascending hairs: anthers long-acuminate. Northern. 6. C. ELEGANS.
Taller: petals lilac; fringe of the gland reflexed: anthers acuminate: capsule elliptic, acutish. Northern. 7. C. TOLMIEI.
Petals not hairy or only at base: low: anthers obtuse.
Petals naked; gland with an appressed scale: anthers 2 or 3 lines long: capsule oblong, acute. Sierra Nevada. 8. C. NUDUS.
Gland with a scale and ciliate: anthers a line long: capsule elliptical, obtuse. Coast Ranges. 9. C. LILACINUS.
Flowers usually solitary: gland densely hairy. Coast Ranges. 10. C. UNIFLORUS.
Pedicels stout, usually erect in fruit: flowers large, lilac, hairy at base: anthers acute. 11. C. GREENEI.
* * Pedicels erect: flowers open-campanulate: gland densely hairy: capsule narrowly oblong with thick obtusely angled lobes, acute, septicidal: seeds somewhat turgid, with loose white spongy testa.
Flowers yellow or orange, marked with purple or brown. Coast Ranges.
Hairs upon the petals clavate. 12. C. CLAVATUS.
Hairs upon the petals very slender.
Petals deep yellow or purple, hairy and ciliate. 13. C. WEEDII.
Petals reddish-orange, deep purple at base, nearly naked. 14. C. KENNEDYI.
Petals usually yellow, purple at base and lined or spotted with brownish purple in the centre, slightly hairy below. 15. C. LUTEUS.
Flowers white or lilac: petals slightly hairy below.
Of the Coast Ranges and S. California.
Petals with a reddish spot near the top, a brownish spot in the centre and a brownish base. 16. C. VENUSTUS.
Petals clear lilac, paler below: anthers purple, 3 to 6 lines long. 17. C. SPLENDENS.
Flowers small, white, yellowish at base: anthers yellow, 3 lines long: stem very slender. 18. C. PALMERI.
Of N. California and the Sierra Nevada.
Stout, erect, leafy, 1–2-flowered: petals lilac: anthers acutish. 19. C. MACROCARPUS.
Slender, often low, umbellately 1–5-flowered: petals whitish above with a purple spot above the yellow base: anthers obtuse, sagittate. 20. C. NUTTALLII.
* * * Pedicels erect: capsule narrowly oblong with thick obtusely angled lobes, obtuse, loculicidal: seeds flat, horizontal, with thin close testa. 21. C. CATALINÆ.

§ 1. *Petals strongly incurved or arched, with a broad transversely crested or more or less hairy pit above the base: sepals naked, rarely spotted: capsule elliptical or broadly oblong, deeply triquetrous and septicidal, the thin compressed lobes acute or winged: flowers or fruit more or less nodding: seeds ascending, the testa mostly brownish, close and pitted.* — EUCALYCHORTUS.

* *Flowers subglobose with concave petals, nodding: stem usually tall and branching.*

1. **C. albus,** Dougl. Glaucous and branching, a foot or two high, with elongated radical leaves ½ to 2 inches wide, and large foliaceous bracts: petals pure white (the claw purplish), ovate-orbicular, acutish, 12 to 15 lines long, bearded above the gland and ciliate with long white hairs; gland lunate, shallow, with four transverse imbricate scales fringed with close short yellow or white glandular hairs: anthers linear-oblong, obtuse, mucronate: ovary attenuate above: capsule an inch or two long, 6 to 12 lines broad, abruptly short-beaked: seeds brown, pitted. — *Cyclobothra alba,* Benth. in Trans. Hort. Soc. i. 413, t. 14, fig. 3; Lindl. Bot. Reg. t. 1661.

Var. **paniculata,** Baker, l. c. Stem more slender and less branched, with narrower leaves and bracts: flowers smaller, on short solitary pedicels. — *Cyclobothra paniculata,* Lindl. l. c.

Frequent on the foothills of the Coast Ranges from Los Angeles County to Sonoma; also in the foothills of the Sierra Nevada (Placer County, *Bolander*).

2. **C. pulchellus,** Dougl. Stem somewhat flexuous, with spreading branches, a foot high or more, or sometimes only 2 or 3 inches high and 2–3-flowered: radical

leaf equalling or exceeding the stem, 4 to 12 lines broad; bracts linear-lanceolate, exceeding or equalling the flowers: sepals yellow or greenish, 8 to 12 lines long, a little shorter than the yellow or orange oblong- or broadly ovate acutish petals, which are glandular-ciliate and sparingly sprinkled with short erect yellow hairs; gland a deep pit projecting upward and covered by the stiff appressed yellow hairs growing on the upper margin: anthers broad, obtuse or acutish: capsule elliptical, 12 to 15 lines long and 6 to 8 broad, obtuse. — Wood, Proc. Philad. Acad. 1868, 168. *Cyclobothra pulchella*, Benth. l. c., t. 14, fig. 1; Lindl. Bot. Reg. t. 1662.

In the Coast Ranges from Monterey to Mendocino County.

* * *Flowers campanulate with less incurved and less arched petals, erect when open: pedicels slender, recurved in fruit: stem low.*

+– *Flowers yellow.*

3. **C. Benthami,** Baker. Resembling the last: low and slender (3 to 6 inches high), 2–6-flowered: leaves much elongated, 2 to 5 lines broad: flowers smaller and nearly erect; petals 6 or 7 lines long and mostly obtuse, rather densely covered with yellow hairs, and with a shallow lunate gland above the brownish or often deep brown claw: anthers acute: capsule nodding, 6 to 9 lines long. — Journ. Linn. Soc. xiv. 304. *Cyclobothra elegans*, var. *lutea*, Benth. Pl. Hartw. 338. *C. nitidus*, Torr. Pacif. R. Rep. iv. 146, not Dougl.; Wood, l. c. 169.

In the Sierra Nevada, from Mariposa to Butte Counties.

+– +– *Flowers white or light lilac.*

++ *Petals covered with hairs and mostly ciliate.*

4. **C. Maweanus,** Leichtlin. Stem low and flexuous (3 to 10 inches high), usually branched and 3–6-flowered: leaves glaucous, exceeding the stem, 4 to 6 lines wide; bracts lanceolate, an inch long or more: petals white or purplish blue, at least at base, 6 to 8 lines long, exceeding the purplish sepals, broadly obovate, acute, somewhat pitted and arched, the broad naked claw covered above by a transverse semicircular scale, and the rest of the surface more or less densely covered with long erect white or purplish hairs: anthers lanceolate, acuminate, 2 or 2½ lines long: capsule oblong-elliptic, acutish. — Baker, l. c. 305, under *C. elegans*. *Cyclobothra elegans*, Torr. Pacif. R. Rep. iv. 146. *Calochortus elegans*, Hook. f. Bot. Mag. t. 5976.

Near the coast from San Francisco (at Punta de los Reyes, *Bigelow*) northward to Humboldt County (*Rattan*); Butte County, near Chico, *Mrs. Bidwell.*

5. **C. cæruleus,** Watson. Low and very slender (3 to 6 inches high), the solitary leaf (1 to 3 lines broad, strongly nerved) much exceeding the simple umbellately 2–5-flowered stem: bracts small, 4 to 9 lines long: pedicels very slender, 1½ inches long or less: sepals 6 or 7 lines long, about equalling the rhombic-obovate acute rather deeply pitted and arched petals, which are lilac more or less dotted and lined with darker blue; claw narrower; gland transversely divided by a broad semicircular fringed scale which is closely appressed over the upper half; the rest of the petal covered and fringed with slender hairs: anthers oblong, obtuse, 1½ or 2 lines long: capsule orbicular or nearly so, 6 lines long, not beaked. — Proc. Amer. Acad. xiv. 263. *Cyclobothra elegans*, var., Benth. Pl. Hartw. 338 (n. 1988). *Cyclobothra cærulea*, Kellogg, Proc. Calif. Acad. ii. 4. *C. glaucus*, Regel, Act. Hort. Petrop. iii. 285?

In the Sierra Nevada, from Placer to Plumas Counties.

6. **C. elegans,** Pursh. Resembling the last: leaves rather broader (3 to 8 lines wide): flowers greenish white, purplish at base; petals not ciliate on the margin or sparingly so, and the upper part of the gland covered by a very narrow deeply fringed ascending scale: anthers long-acuminate: otherwise like the last. — Fl. i. 240; Dougl. in Trans. Hort. Soc. vii. 278, t. 9, fig. B.

Var. **nanus**, Wood, l. c. Dwarf and slender: leaves very narrow: petals more hairy and ciliate, often acute or even acuminate. — *C. Lyallii*, Baker, l. c. 305.

Oregon and Idaho; the earliest known species of the genus, to which the last two and several of the following have usually been referred. The variety has been collected on the mountains west of Yreka (*Wood*), on Mount Hood, and northward to British Columbia, *Lyall.*

7. **C. Tolmiei**, Hook. & Arn. Another similar species, but stouter and taller (about a foot high) and usually branched: leaves 4 to 6 lines broad, not greatly exceeding the stem; bracts larger: flowers larger, tinged or marked with lilac; petals 9 to 15 lines long, very broadly obovate and scarcely acute, rather deeply pitted, covered and fringed with long purple and white hairs; gland without scale, but the upper circular edge with a dense fringe of reflexed hairs: anthers lanceolate and acuminate, 2 or 3 lines long: capsule broadly elliptical, acutish at each end, 10 to 15 lines long. — Bot. Beechey, 398. *C. elegans*, var., Baker, l. c. 305.

Oregon; foot of Mount Shasta, *Wood.*

C. APICULATUS, Baker, of Northern Idaho, resembles this species, but is taller and stout, with a single umbel of larger straw-colored flowers.

++ ++ *Petals hairy only toward the base or wholly naked.*

8. **C. nudus**, Watson, l. c. Low and often slender (2 to 10 inches high), with a single elongated leaf 3 to 10 lines broad; bracts usually small (an inch long or less): flowers 1 to 6, usually in a single umbel: sepals about equalling the broadly fan-shaped petals, which are 4 to 10 lines long, white or pale lilac, denticulate above, and wholly without hairs; gland shallow, divided by a broad transverse denticulate appressed scale: anthers linear-oblong, obtuse, 2 or 3 lines long, about equalling the filaments: capsule oblong, acute at each end, 8 or 10 lines long and 4 or 5 wide: seeds yellowish, papillose, with a white vesicle at base. — *Cyclobothra elegans*, var., Benth. Pl. Hartw. 338 (n. 1986); Torr. l. c. *Calochortus elegans*, var. *subcalvatus*, Baker, l. c. 305.

In the Sierra Nevada, from the Yosemite Valley to Plumas County.

9. **C. lilacinus**, Kell. Stem bulbiferous near the base, low (4 to 8 inches high), rather stout, usually branched, with broad elongated leaves (4 to 6 lines wide), and long conspicuous bracts: flowers 4 to 10, in 1 to 3 umbels or close corymbs, on long flexuous pedicels: petals broad, 6 to 12 lines long, pale lilac, with a more or less purplish claw, somewhat hairy below the middle; gland very shallow, ciliately margined and with a narrow scale: anthers oblong, obtuse, 1 to 1½ lines long, much shorter than the filaments: stigmas slender: capsule elliptical, obtuse at each end, an inch long. — Proc. Calif. Acad. ii. 5; Baker, l. c. 306. *C. umbellatus*, Wood, l. c 168. *C. uniflorus*, Hook. f. Bot. Mag. t. 5804.

On hillsides about San Francisco Bay (*Bigelow, Bolander, Kellogg*) and northward; at the Geysers, *Bolander.*

10. **C. uniflorus**, Hook. & Arn. Stem low and slender (3 to 6 inches high), 1–2-flowered: leaves 2 to 4 lines broad; bracts near the base, elongated: sepals 6 to 8 lines long, purplish, sometimes spotted: petals 10 to 12 lines long, the upper margin denticulate, lilac with a purplish base and small very shallow purple densely hairy gland, the lower half of the petal above the gland covered with scattered hairs: anthers obtuse, 2 lines long. — Bot. Beechey, 398, t. 94; Wood, l. c. 168; Baker, l. c. 306.

From Monterey (*Douglas, Parry, Brewer*) to Sonoma County, *Newberry.* The stem is bulbiferous at the base of the leaf; capsule not known.

§ 2. *Flowers and fruit erect on stout pedicels: flowers open-campanulate: gland usually densely hairy: capsule (except in group *) narrowly oblong, with thick lobes, acute, septicidal sepals often hairy or subglandular or spotted within: seed ascending and somewhat turgid, with white, loose and spongy, minutely tessellated testa.* — MARIPOSA.

* *Capsule as in* § 1: *flowers large, lilac.*

11. **C. Greenei**, Watson. Stem stout, branching, often a foot high or more, 2 – 5-flowered: leaf about equalling the stem, an inch broad; bracts narrow, elongated: sepals greenish with more or less of lilac within and with a yellowish hairy spot above the base: petals broadly fan-shaped and obtuse, 1¼ to 1½ inches long, lilac, somewhat barred with yellow below, strongly pitted and arched, the lower part densely covered with very long yellow hairs; upper part of the blade more thinly hairy, not ciliate; pit densely villous above a broad transverse laciniate scale: anthers broad, acute or obtuse, ½ inch long: capsule an inch long, 4 to 6 lines broad, attenuate into a stout beak. — Proc. Amer. Acad. xiv. 264.

Mountains near Yreka, and top of Table Rock on Little Shasta River, *Rev. E. L. Greene*, July, 1876; also in Multnomah County, Oregon, *T. J. Howell.*

C. NITIDUS, Dougl. (*C. eurycarpus*, Watson, Bot. King Exp. 348), has a simple umbellately 1 – 3-flowered stem, with a short bract-like leaf in the middle and a single narrow radical leaf; sepals naked; petals cream-colored with a lilac spot in the centre, and a narrow shallow pit, not strongly arched, the lower part of the blade usually with thinly scattered purple or yellowish hairs; gland oval-oblong, densely covered with entangled yellow hairs, without crest; anthers 2½ to 4 lines long; capsule round to broadly elliptical, with short stout beak. Oregon to N. E. Nevada.

* * *Capsule narrowly oblong, with thick obtusely angled cells.*

+– *Flowers yellow or orange, more or less marked with brown or purple.*

12. **C. clavatus**, Watson. In habit resembling *C. luteus:* distinguished from other species of the group by the strongly clavate hairs which cover the lower half of the petal around the deep and broad circular gland: sepals acute, naked, yellow within with a brownish spot at base and greenish on the outer side: petals 15 to 18 lines long, yellow somewhat tinged or lined with brown, rather strongly arched: anthers purple, obtuse, 4 or 5 lines long: ovary attenuate above, narrow, 10 lines long. — Proc. Amer. Acad. xiv. 265.

Near San Luis Obispo (*J. G. Lemmon*); near Santa Barbara, *Mrs. Elwood Cooper.*

13. **C. Weedii**, Wood. Corm deep-seated, fibrously coated: stem usually branched, leafy, flexuous, a foot high or more, 1 – 3-flowered: leaves convolute-linear, filiform-acuminate: sepals equalling the petals, orange within, with a brown slightly bearded spot at base: petals 12 to 15 lines long, fan-shaped, obtuse or abruptly acute, deep yellow, dotted and often margined with brownish purple, ciliate and covered with slender purple or yellow hairs; gland small, circular to oblong, densely hairy: anthers broad, acute or acutish, 4 to 6 lines long: capsule narrow, attenuate upward, 1½ inches long. — Proc. Acad. Philad. 1868, 169. *C. luteus*, var. *Weedii*, Baker, l. c. 309. *C. citrinus*, Baker, Bot. Mag. t. 6200.

Var. **purpurascens**, Watson, l. c. Petals wholly covered or blotched with purple; gland somewhat larger.

In the Coast Ranges, San Diego County and northward; the variety at Santa Barbara and Cajon Pass.

14. **C. Kennedyi**, Porter. Usually stout, 4 to 18 inches high, glaucous, 2 – 4-flowered; pedicels often short and stout: leaves shorter than the stem: sepals broad, scariously margined, orange within with a purple spot at base, about equalling the fan-shaped petals, which are 12 to 15 lines long, of a uniform clear reddish orange, the round-oblong gland densely hairy and surrounded by a broad deep-purple slightly hairy spot: anthers 4 lines long, on very short filaments: capsule 1½ inches long or more. — Coult. Bot. Gazette, ii. 79.

Southeastern California, from Fort Tejon to the Providence Mountains, *Wallace, Cooper, Palmer, Kennedy.*

15. **C. luteus**, Dougl. Stem bulbiferous near the base, usually a foot or two high, 1 – 6-flowered, exceeding the usually very narrow (1 to 3 lines wide) leaves:

sepals nearly equalling the petals, narrowly lanceolate and acuminate, greenish yellow and purplish with a brown spot at base: petals very broadly fan-shaped, obtuse, an inch or two long, from yellow to deep orange, lined with brownish purple on especially the middle third where it is also usually slightly hairy; claw purplish; gland broad, rounded or somewhat lunate, densely covered with ascending yellowish hairs and with scattered spreading hairs surrounding it: anthers yellow, linear, obtuse, 2½ to 5 lines long: capsule attenuate upward, 1 to 1½ inches long. — Lindl. Bot. Reg. t. 1567; Fl. Serres, ii. t. 104, fig. 2; Baker, l. c. 309.

Var. **oculatus,** Watson, l. c. Petals white, lilac, or yellowish, with a central dark brownish purple spot, which is usually bordered with yellow and sometimes more or less broadened transversely; claw yellow and purplish; gland usually narrowly lunate, covered with brownish or yellow hairs.

Var. **citrinus,** Watson, l. c. The whole petal deep or lemon yellow, similarly marked with brown. — *C. venustus,* var. *citrinus,* Baker, l. c. 310.

Frequent from San Diego to Mendocino County and in the foothills of the Sierra Nevada. Exceedingly variable in its color and markings, and perhaps running into *C. venustus.*

C. AUREUS, Watson, of S. Utah, is another species of this group, 3 to 6 inches high, the petals naked and clear yellow or with a narrow crescent of purple above the well-defined roundish gland, which is densely covered with reflexed hairs.

+– +– Flowers white or lilac.

16. **C. venustus,** Benth. Like the last: petals white or pale lilac above, with a more or less conspicuous reddish spot near the top, a brownish spot bordered with yellow in the centre, and a brownish base: gland large and conspicuous but much narrower than the claw, oblong, usually densely hairy and surrounded by scattered hairs: capsule 1 to 2½ inches long and 4 or 5 lines broad. — Trans. Hort. Soc. n. ser. i. 412, t. 15, fig. 3; Lindl. Bot. Reg. t. 1669; Fl. Serres, l. c. fig. 3; Regel, Gartenfl. t. 865.

Var. **purpurascens,** Watson, l. c. The petals deep lilac or purplish, with similar markings. — Vars. *lilacinus* and *purpureus,* Baker, Gard. Chron. 2 ser. viii. 70.

In the Coast Ranges, from Mount Diablo (*Brewer*) southward; frequent and very variable in its colors and in the definition of its markings. The variety in Kern County, *Wallace, Kennedy.*

17. **C. splendens,** Dougl. Like the preceding: petals clear lilac, paler below (the claw somewhat darker), with scattered white hairs below the middle, and with or without a round densely hairy gland: anthers purple, obtuse or acute, 3 to 6 lines long. — Benth. l. c. 411, t. 15, fig. 1; Lindl. l. c., t. 1676; Fl. Serres, l. c. fig. 1.

Frequent from Monterey to San Diego.

C. FLEXUOSUS, Watson, of S. Utah, is a similar species, distinguished especially by shorter obtusish sepals, the shorter anthers (1½ to 3 lines long), and the shorter oblong capsule (an inch long) less attenuate at each end: stem lower and very flexuous, not bulbiferous.

18. **C. Palmeri,** Watson, l. c. Stem very slender, lax and flexuous, a foot or two high, 1–7-flowered, bulbiferous at base: leaves shorter than the stem, a line or two broad: sepals equalling the petals, with narrowly acuminate recurved tips, yellowish within and with a purple spot at base: petals a half to an inch long, obtuse or acutish, white, or yellowish toward the base, with a brownish claw; gland roundish and ill-defined, nearly as broad as the claw, densely hairy and surrounded above by scattered yellow hairs: anthers obtuse, 3 lines long: capsule very narrow, attenuate upward, an inch long or more.

Near the Mohave River, *Palmer* (n. 527, 1876).

19. **C. macrocarpus,** Dougl. Often stout, erect and rigid, a foot or two high, 1- rarely 2-flowered, leafy: leaves shorter than the stem, the cauline (3 to 5) narrow and convolute: sepals about equalling the petals, acuminate, usually tinged with lilac within, darker at base with sometimes a yellowish hairy spot: petals obovate,

acute or acuminate, 1½ to 2 inches long, purple-lilac, paler at base, with a greenish line down the middle, the lower third above the gland covered with scattered glandular hairs; gland oblong, densely hairy: anthers purple or yellow, lanceolate, acutish, 4 to 6 lines long: capsule attenuate upward, 1½ to 2 inches long: seeds flattened, 2½ lines long. — Hort. Trans. vii. 276, t. 8; Lindl. Bot. Reg. t. 1152.

At Soda Springs on the Little Shasta River (*Greene*); Camp Bidwell (*Matthews*); and northward to Washington Territory (*Lyall*) and Idaho, *Spalding*.

20. **C. Nuttallii,** Torr. & Gray. Erect, slender, usually a foot high, bulbiferous at base, simple and umbellately 1–5-flowered, with a single or rarely 2 or 3 narrow revolute cauline leaves: sepals ovate-lanceolate with scarious margins, yellowish within, with often a dark sometimes hairy spot near the base: petals cuneate-obovate, obtuse or often abruptly acute, an inch or two long, white above tinged with greenish yellow or lilac and with a purplish spot or band above the yellow base; gland round or oblong, densely hairy, surrounded by long scattered hairs: anthers obtuse, sagittate at base, 3 or 4 lines long: capsule attenuate upward, 1 to 2½ inches long: seeds as in the last. — Pacif. R. Rep. ii. 124; Baker, l. c. 306, excl. syn. *Fritillaria alba*, Nutt. Gen. i. 222. *C. luteus*, Nutt. in Journ. Acad. Philad. vii. 53. *C. Leichtlinii*, Hook. f. Bot. Mag. t. 5862.

In the Sierra Nevada from Ebbett's Pass (at 13,000 feet altitude, *Brewer*) to Shasta River and eastward to the headwaters of the Missouri, the Black Hills of Dakota, S. Utah and New Mexico; the most widely distributed species of the genus. The color sometimes varies to deep lilac. The high mountain form is often dwarf and has the anthers more sagittate.

C. Gunnisoni, Watson, common in the Rocky Mountains from Nebraska to New Mexico, is a similar species, readily recognized by its acuminate anthers, the light-lilac petals yellowish green below the middle, banded and lined with purple, the lower part hairy and the transverse gland nearly as broad as the claw.

§ 3. *Fruiting pedicels erect: capsule narrowly oblong, obtuse, loculicidally dehiscent at the summit: seed flat and horizontal in one row in each cell, with close white testa.*

21. **C. Catalinæ,** Watson. Stem 2 feet high, branching, from a small oblong-ovate corm: leaves and bracts very narrowly linear: ovary winged: capsule triangular, very obtuse, an inch or two long by 4 or 5 lines wide: seeds thin and very numerous, 2 lines in diameter; testa minutely pitted. — Proc. Amer. Acad. xiv. 268.

On Santa Catalina Island, off Los Angeles. Collected by *Mr. Paul Schumacher*, June, 1878, in fruit only.

22. STREPTOPUS, Michx. Twisted-Stalk.

Perianth narrowly campanulate, of 6 distinct lanceolate deciduous reticulately nerved segments, with recurved tips. Stamens 6, on the base of the segments; filaments short and deltoid or subulate; anthers sagittate, acute or acutely attenuate above, or each cell setaceously apiculate, attached on the inner side near the base, with nearly lateral dehiscence. Ovary sessile, ovate, 3-celled, many-ovuled: style filiform, deciduous; stigma 3-cleft or 3-lobed. Fruit a thin globose or ovate-oblong reddish berry, the cells several seeded. Seeds oblong with close thin brownish testa, longitudinally striate. — Stems leafy, dichotomously branching, glaucous, from slender creeping rootstalks; leaves alternate, sessile or clasping, lanceolate, many-nerved with transverse veinlets; flowers solitary on slender extra-axillary simple or once-forked peduncles, the second flower and pedicel often rudimentary.

Two Asiatic species are known in addition to the following.

1. **S. amplexifolius,** DC. Glabrous throughout and glaucous: rhizome short with crowded rootlets: stem 2 or 3 feet high: leaves ovate- to oblong-lanceolate,

deeply cordate and clasping, 2 to 5 inches long, very rarely slightly scabrous on the margin: peduncles lateral and twisted beneath the leaves, mostly forked or geniculate, a half to an inch long: perianth greenish white, 4 to 6 lines long, recurved above the middle: anthers 1½ or 2 lines long, attenuate to a single slender awn; filament deltoid: style elongated; stigma slightly 3-lobed: berry globose to oblong-ovate, 4 to 6 lines long, the cells 10–14-seeded. — *S. distortus*, Michx.; Hook. Fl. Bor.-Am. ii. 173, t. 188.

Common in the temperate regions of Europe, Asia and N. America; in the United States ranging south in the mountains to Pennsylvania, New Mexico and Utah, Oregon, and more rarely Northern California. Collected only by *Bolander*, in a deep gulch near Noyo, Mendocino County; June.

S. roseus, Michx. Fl. ii. 201, t. 18; usually lower and more slender than the last, and somewhat pubescent; leaves scabrous-ciliate, less cordate or only clasping; pedicels rather shorter; flowers rose-purple, 3 or 4 lines long; anther-cells each apiculate; stigma 3-cleft: fruit globose, the cells 6–8-seeded. From Sitka to Oregon, and perhaps Northern California; also in British America and the northern Atlantic States.

S. brevipes, Baker, Journ. Linn. Soc. xiv. 592, is known only from small fruiting specimens collected by *Dr. Lyall* in the Cascade Mountains of Washington Territory. It is glabrous throughout, with very slender rootstocks; leaves sessile, not at all cordate at base nor ciliate; fruit globose, on pedicels 3 or 4 lines long, the cells 2–8-seeded. It is perhaps only a reduced smooth form of the last.

23. PROSARTES, D. Don.

Perianth narrowly campanulate, of 6 distinct oblanceolate deciduous 3–5-nerved and net-veined white or greenish segments. Stamens 6, hypogynous; filaments filiform, mostly elongated; anthers oblong, obtuse, attached within above the base, dehiscent laterally. Ovary sessile, linear, oblong or ovate, 3-celled, mostly with 2 suspended ovules in each cell: style slender, entire, or with 3 short spreading stigmas, deciduous. Fruit a red 3–6-seeded berry. Seeds subglobose, with thin close testa and horny albumen. — Stems scaly-bracted below, widely branched and leafy above, from running rootstalks; leaves alternate, sessile (at least the lowest clasping), thin, ovate or lanceolate, several-nerved and net-veined, the uppermost oblique; flowers solitary or fascicled at the ends of the branches, the slender pedicels not jointed, usually nodding. — Watson, Proc. Amer. Acad. xiv. 270.

A wholly North American genus; two other species are found in the Atlantic States.

* *Perianth broad and gibbously truncate at base: stamens included, with elongated filaments: style 3-cleft: fruit acute: leaves acuminate, rarely somewhat cordate.*

1. **P. Menziesii**, Don. More or less woolly-pubescent: stems 1 to 3 feet high: leaves ovate to ovate-lanceolate, narrowly acuminate or the lowest acute, rounded at base or sometimes slightly cordate, 2 to 5 inches long, often minutely resinous-dotted, at length shining beneath, 3–5-nerved, the fainter secondary nerves solitary: flowers 1 to 5: perianth-segments nearly erect, acute, 6 to 11 lines long: stamens a third shorter: style usually more or less woolly above and slightly 3-cleft at the summit: ovary nearly smooth: capsule oblong-obovate, attenuate above into a short usually somewhat villous beak, triangular, 3–6-seeded, about 6 lines long, bright salmon-color. — Linn. Trans. xviii. 533. *Uvularia Smithii*, Hook. Fl. Bor.-Am. ii. 174, t. 189.

In the Coast Ranges from Mendocino County to British Columbia; in moist places. May and June. A strongly marked species; the leaves are rather thicker and less transparent than in the following.

* * *Perianth narrower and less gibbous at base: style entire: leaves acute or shortly acuminate, mostly cordate and clasping.*

+ *Filaments elongated, longer than the anthers.*

2. **P. Hookeri,** Torr. More or less rough-pubescent with short usually spreading hairs: stem a foot or two high: leaves ovate, mostly deeply cordate, rough on the margin and nerves beneath, 1½ to 3 inches long, the uppermost very oblique; secondary nerves often 2 or 3: flowers 1 to 6; segments spreading above, 5 or 6 lines long, narrowed at base: stamens nearly equalling or a little exceeding the perianth; anthers 1 to 1½ lines long: ovary narrow, more or less pubescent; the style entire, exserted, glabrous: fruit usually somewhat pubescent, obovate, obtuse, 4 lines long, 6-seeded. — Pacif. R. Rep. iv. 144. *P. lanuginosa,* var. *Hookeri,* Baker, Journ. Linn. Soc. xiv. 586. *Prosartes,* n. sp., Kellogg, Proc. Calif. Acad. vii. 112.

Var. **oblongifolia,** Watson. Leaves mostly oblong, acuminate.

In the Coast Ranges from Marin County to Santa Cruz; April to June.

3. **P. trachyandra,** Torr. Very similar to the last: leaves less deeply cordate (the upper ones often not at all so) and usually less acuminate: stamens a third shorter than the perianth; anthers minutely hispid: ovary glabrous: fruit smooth, with a short stout beak. — Pacif. R. Rep. iv. 144. *P. lanuginosa,* var. *trachyandra,* Baker, l. c.

In the Sierra Nevada, from Tuolumne County (*Bigelow*) to Plumas County, *Lemmon, Mrs. R. M. Austin.*

P. Oregana, Watson, of Oregon and Washington Territory, is distinguished by its long-acuminate cordate leaves; pedicels and upper portion of the branches usually densely woolly-pubescent; spreading perianth-segments (5 to 7 lines long) more distinctly (often purplish) net-veined; stamens exserted; fruit somewhat pubescent, ovate, acutish, nearly half an inch long, 3–6-seeded.

P. trachycarpa, Watson, is a more eastern species of the Wahsatch and Rocky Mountains, ranging north to British America. It has acute sessile not cordate leaves, stamens about equalling the perianth, a slightly cleft style, rounded ovary, and obovate obtuse papillose 6–18-seeded fruit.

+ + *Anthers much exceeding the very short filaments.*

4. **P. parvifolia,** Watson, ined. Rather stout, much branched, woolly-pubescent: leaves ovate to broadly lanceolate, the lower cordate and clasping, 1 to 1½ inches long, acuminate: flowers rather numerous, 4 lines long; segments slightly spreading, twice longer than the lanceolate acute nearly sessile anthers: ovary very small, slightly pubescent; style slightly exserted.

Siskiyou Mountains; collected in flower, June, 1879, by *V. Rattan.*

24. CLINTONIA, Raf.

Perianth campanulate, of 6 distinct oblanceolate deciduous several-nerved segments. Stamens 6, on the base of the segments; filaments filiform; anthers oblong to linear, versatile, attached on the inner side above the base, dehiscing laterally. Ovary sessile, ovate-oblong, 2–3-celled: cells 2–several-ovuled; style slender, slightly 2–3-lobed at the summit, deciduous. Fruit a smooth ovoid thin few–many-seeded berry. Seed with smooth brownish crustaceous testa, somewhat compressed and angled. — Stems very short, few-leaved, from a slender creeping rootstock, bearing a scape-like peduncle with solitary or umbelled flowers; leaves apparently radical, alternate, large, oblanceolate, sheathing, many-nerved with transverse veinlets, ciliate.

A genus of half a dozen species, divided equally between the Atlantic States, the Pacific coast, and Eastern Asia.

1. **C. uniflora,** Kunth. More or less villous-pubescent throughout: stem very short (an inch or two long), mostly subterranean: leaves 2 to 5, acute, attenuate

below, 4 to 8 inches long and 1 or 2 broad: peduncle shorter than the leaves, usually with one or two small bracts: flowers solitary, rarely 2, white, 9 to 12 lines long, pubescent: filaments nearly a half shorter, pubescent, very attenuate at the apex; anthers 2 lines long: style exceeding or shorter than the stamens: fruit 4 to 6 lines long, the cells 6–10-seeded. — Enum. v. 159; Baker, Journ. Linn. Soc. xiv. 584. *Smilacina uniflora*, Menz.; Hook. Fl. Bor.-Am. ii. 175, t. 190.

Northern California to British Columbia; Big Tree Grove (*Brewer*); Plumas County (*Mrs. R. M. Austin*); near Eagle Lake (*Miss Plummer*); Humboldt County (*Rattan*); Scott Mountains, *Greene*.

2. **C. Andrewsiana**, Torr. Stout, nearly glabrous, the inflorescence more or less pubescent: stem 2 to 6 inches long: leaves usually 5 or 6, broadly oblong to oblanceolate, 6 to 12 inches long and 2 to 4 wide, acute or very shortly acuminate: peduncle a foot or two high, usually with a foliaceous bract: flowers deep rose-color, numerous, in a terminal umbel and one or more lateral umbellate fascicles; pedicels slender, unequal, an inch long or less: perianth gibbous at base, 4 to 7 lines long: stamens a half shorter, about equalling the style; filaments pubescent; anthers a line long: fruit 4 or 5 lines long, the cells 8–10-seeded. — Pacif. R. Rep. iv. 150; Baker, l. c. 585.

In the Coast Ranges from Santa Cruz (*Kellogg, Anderson*), to Humboldt County (*Rattan*); April to June.

25. SCOLIOPUS, Torr.

Perianth purplish, of 6 distinct spreading deciduous segments; the 3 outer lanceolate, several-nerved, punctate; the inner narrowly linear, 3-nerved. Stamens 3, at the base of the outer segments; filaments filiform-subulate; anthers oblong, 2-celled, extrorse, attached above the base. Ovary sessile, narrow and attenuate upward, strongly triquetrous, 1-celled, the thickened angles placentiferous: style very short: stigmas linear, recurved, deeply channelled down the inner side, persistent: ovules several (10) in 2 rows on each placenta, ascending. Capsule thin-membranous, bursting irregularly, oblong-lanceolate. Seeds oblong, slightly curved, sulcate-striate longitudinally, with thin close light-colored testa, a conspicuous dark chalaza, and crested rhaphe. — Nearly acaulescent glabrous perennials, with a short coarsely fibrous-rooted rhizome; the very short stem bearing a pair of thin oval to lanceolate sessile leaves, many-nerved with transverse veinlets, subtending an umbel of long-petioled flowers. The whole plant is more or less punctate with purple dots.

Only the following species are known. A remarkable genus of rather obscure affinities, but apparently to be grouped with *Trillium* and the eastern monotypical genus *Medeolus*.

1. **S. Bigelovii**, Torr. Stem scarcely rising above ground: leaves oval-elliptic to narrowly oblanceolate, 4 to 15 inches long and 1½ to 4 inches wide, acute or acutish, dilated and sheathing at base: pedicels 3 to 12, slender, 3 to 8 inches long, lax and becoming tortuous in fruit: perianth 7 to 9 lines long: stamens a third as long: ovary linear-oblong, 3 to 5 lines long including the short stout style: stigmas 2 lines long: capsule light-colored, acute at each end, 9 to 14 lines long not including the style, which is 2 or 3 lines long: seeds few to many, 1 to 1½ lines long. — Pacif. R. Rep. iv. 145, t. 22.

In the Coast Ranges from Marin to Humboldt County; flowering in February.

S. Hallii, Watson, from the Cascade Mountains of Oregon, is distinguished by its smaller leaves (3 to 5 inches long) more narrowed and somewhat petiolate at base; the very slender pedicels 2 inches long or less; ovary less narrowly oblong; style more slender, and stigmas only a line long; capsule brown-purple, 5 lines long. The stem is scarcely an inch in length, and the rhizome and rootlets are more slender; flowers unknown.

26. TRILLIUM, Linn. Wake Robin.

Perianth of 3 herbaceous lanceolate persistent sepals and as many larger distinct more or less spreading colored (white to purple) several-nerved marcescent petals. Stamens 6, on the base of the perianth and much shorter than the segments; filaments short and stout; anthers linear, the cells separated by a broad connective, usually introrse. Ovary sessile, ovate-globose, 3–6-angled, 3-celled, several-ovuled: stigmas nearly sessile, linear or subulate, recurved above, channelled. Fruit an ovate berry, 3-celled (or sometimes imperfectly 1-celled with parietal placentæ), red or purple. Seeds ovate, with thick rhaphe and close thin scarcely striate testa. — Perennial glabrous herbs, with short tuber-like rhizomes, and stout simple stems scariously sheathed at base, and bearing at top a whorl of 3 dilated mostly rhombic-ovate 3–5-nerved and net-veined leaves, and a large solitary flower. — Watson, Proc. Amer. Acad. xiv. 273.

The dozen species are chiefly American and of the Atlantic States. Two are found in E. Asia, of which one is considered a form of an eastern species. The roots are acrid and produce emesis.

* *Flowers sessile.*

1. **T. sessile,** Linn. Stems usually several from the same root, about a foot high: leaves closely sessile, ovate-elliptic and often rhombic, usually mottled with brown, acute: petals dull purple or sometimes greenish white, oblanceolate or spatulate, acute or obtuse, ½ to 2 inches long, erect or spreading: anthers 3 to 7 lines long, equalling or exceeding the stout stigmas, which are 3 or 4 lines long and sessile upon the broadly ovate ovary.

Var. **Californicum,** Watson, l. c. Larger in all its parts: leaves very broadly rhombic-ovate, 3 to 6 inches long and usually broader than long, acutish: petals oblanceolate to rhombic-obovate, 1 to 4 inches long, purple or rose-color or sometimes white: anthers 6 to 9 lines long, usually considerably exceeding the stigmas. — *T. sessile,* vars. *giganteum* and *chloropetalum,* Torr. in Pacif. R. Rep. iv. 151.

Var. **angustipetalum,** Torr. l. c. Leaves narrowed at base and somewhat petiolate: petals narrowly oblanceolate to linear. — *T. sessile,* var. *giganteum,* Hook. & Arn. Bot. Beechey, 402.

Frequent in rich moist valleys and hillsides, from San Luis Obispo to Oregon, especially the var. *Californicum.* The strictly typical form of the Eastern States seems not to be found in California. Very variable in the size, form and color of the flowers. Flowering from March to May; the fruit of the western forms has not been collected.

T. petiolatum, Pursh, of Oregon and Washington Territory, is distinguished by the short stem scarcely exserted from the basal sheaths (3 or 4 inches long), and by the ovate-elliptic to reniform leaves with petioles equalling or exceeding the blade; petals narrowly oblanceolate, but little longer than the sepals. Not yet collected in California.

* * *Flowers peduncled.*

2. **T. ovatum,** Pursh. Stem rather slender, a foot high or more: leaves rhombic-ovate, 2 to 6 inches long, acute or shortly acuminate, narrowed at base or slightly petiolate: peduncle erect, 1 to 3 inches long: petals spreading, lanceolate or rarely somewhat oblanceolate, acute, 1 or 2 inches long and 3 to 10 lines broad, white soon turning to deep rose-color, little exceeding the sepals: stamens 3 to 6 lines long: stigmas slender, sessile: capsule broadly ovate, somewhat winged, 6 to 9 lines long: seeds 1½ lines long. — Fl. 245. *T. Californicum,* Kellogg, Proc. Calif. Acad. ii. 50, fig. 2.

In the Coast Ranges, from Santa Cruz (*Wood*) to Oregon and British Columbia. This species much resembles the eastern *T. grandiflorum,* to which it has sometimes been referred, but the petals are never obovate and rarely even oblanceolate, and the stigmas are less slender and more recurved.

27. VERATRUM, Tourn. False Hellebore.

Flowers polygamous, mostly cream-color or greenish; segments distinct, spreading, persistent, oblong-obovate or oblanceolate, several-nerved, glandless or with a thickened greenish margin toward the base or somewhat biglandular, slightly adnate to the base of the ovary. Stamens free; filaments subulate; anthers cordate, confluently 1-celled, peltate after opening. Ovary sessile; styles distinct, stigmatic at the apex. Capsule membranous, 3-beaked by the persistent divergent styles, septicidal to the base. Seeds several in each cell, ascending, oblong-lanceolate, compressed and margined or winged, with close thin whitish testa. — Stem stout, tall and leafy, from a short thick rhizome, bearing a pubescent panicle mostly staminate below, with green or greenish bracts; pedicels short and stout, not jointed; leaves ovate to lanceolate, sheathing, strongly nerved and plaited.

A genus of nine species, of which four are European and Asiatic and three belong to the Atlantic States. The roots are poisonous, and those of several species are employed in medicine.

* *Perianth-segments entire or serrulate, thickened laterally at base, very shortly adnate to the oblong-ovate many-seeded membranous capsule.*

1. **V. Californicum**, Durand. Stem very stout, 3 to 7 feet high: leaves ovate, acute, the upper narrowing to lanceolate, 4 to 12 inches long, all sheathing, somewhat pubescent or nearly glabrous: inflorescence and upper part of stem tomentose-pubescent; branches of the panicle (a foot or two long) mostly simple and ascending, sometimes compound and more spreading, the lower usually sterile; bracts ovate-lanceolate, somewhat membranaceous, usually exceeding the pedicels ($\frac{1}{2}$ to $2\frac{1}{2}$ lines long): segments of the perianth oblanceolate, obtuse, whitish, with a greener base, thickened and brown at the sides, the upper margin often somewhat denticulate irregularly, 3 to 8 lines long: stamens 3 to 5 lines long: capsule an inch long or more: seeds 12 to 15 in each cell, whitish, broadly winged, 5 or 6 lines long. — Journ. Philad. Acad. iii. 103. *V. album*, Watson, Bot. King Exp. 344.

Frequent in the Sierra Nevada and in the Coast Ranges of Mendocino County, and northward to the Columbia; also in the East Humboldt Mountains, Nevada, and the Wahsatch (*Watson*), Mount Graham, Arizona (*Rothrock*), and the Rocky Mountains from Wyoming to New Mexico. It appears to differ from all the Old World forms of *V. album*, especially in the darker thickened bases of the more adnate perianth-segments, its larger capsules, and more numerous seeds.

V. viride, Ait., of the Eastern States, also occurs in the mountains of Oregon and northward. Its flowers are green, in a more slender panicle with more or less drooping branches, the segments more narrowly oblanceolate, and stamens shorter. The upper leaves are more acuminate, and the bracts more foliaceous, usually longer and narrower.

* * *Perianth-segments fimbriate, the ridged base divided by a narrow longitudinal sulcus, slightly adnate to the subglobose obtusely lobed thin-membranous capsule.*

2. **V. fimbriatum**, Gray. Stem 2 to 5 feet high or more: leaves lanceolate, 6 to 18 inches long and 2 to 6 inches wide, acute or acuminate, narrowed to the base, somewhat pubescent: panicle tomentose, spreading; bracts ovate to ovate-lanceolate; pedicels stout, 2 to 5 lines long: perianth-segments rhombic-ovate, greenish white (*l*), 3 to 5 lines long, irregularly fimbriate from above the broad base, which is marked by two oblong subglandular spots separated by a narrow furrow and reaching to the middle of the segment: filaments stout, 2 lines long: styles long and slender: capsule depressed and somewhat emarginate at the apex, 4 lines long; cells 5 – 7-ovuled, 2 – 4-seeded: seeds nearly 3 lines long, oblong, scarcely margined. — Proc. Amer. Acad. vii. 391.

Frequent on the plains west of the Redwoods in Mendocino County, *Bolander*, *Kellogg* & *Harford* (n. 1027). A very peculiar species.

28. ZYGADENUS, Michx. ZYGADENE.

Flowers perfect or polygamous, greenish white, erect on slender pedicels in glabrous simple or paniculate racemes; perianth often adnate to the base of the ovary, the oblong-lanceolate to ovate segments more or less distinctly glandular at the rather broad or shortly unguiculate base. Stamens on the base of the segments, the filiform-subulate filaments at first recurved. Seeds brownish, angled and somewhat margined. — Stem from a coated bulb crowning a short rhizome, with narrowly linear obscurely nerved leaves mostly near the base. Otherwise as *Veratrum.*

A genus of half a dozen American species, with one in Siberia and another Mexican.

* *Flowers all perfect, rather large; outer segments not unguiculate, the inner abruptly contracted to a broad claw.*

1. **Z. Fremonti,** Torr. Bulb oblong, ½ to 1½ inches long, with dark outer coats: stem glabrous or rarely somewhat pubescent, from 3 inches to a foot or two or even 4 feet high: leaves 2 to 12 lines broad: raceme simple or compound, few–many-flowered; bracts mostly green; lower pedicels an inch or two long: perianth wholly free from the ovary, rotate; segments 3 to 7 lines long, oblong-ovate to lanceolate, obtusish, the greenish-yellow gland extending upward along the nerves and so toothed on its upper margin: stamens nearly free, a half shorter than the segments: styles short: ovules 10 to 20 or more in each cell: capsule oblong, 6 to 10 lines long: seeds 1½ to 2 lines long. — Pacif. R. Rep. vii. 20 (as *Z. Douglasii*). *Z. glaberrimus,* Hook. & Arn. Bot. Beechey, 160. *Z. chloranthus,* Hook. & Arn. l. c. 402. *Anticlea Fremonti,* Torr. l. c. iv. 144.

In the Coast Ranges from San Diego (*Cleveland, Wood*) to Humboldt County; very frequent and sometimes known as "Soap-plant." It varies greatly in size (the var. *minor* of Hook. & Arn. being the early dwarf form), as also in the size and form of the petals and gland, and in the number of ovules. The gland sometimes occupies the whole base of the petals or may be much narrower. The similar Z. ELEGANS, Pursh (*Z. glaucus,* Nutt., and *Z. chloranthus,* Richards.), of the northern Atlantic States and ranging to Behring Strait and Oregon, is found in Northeastern Nevada and Eastern Arizona, but seems not to reach California. It is more glaucous, has the perianth evidently adherent to the ovary (especially in fruit), and the segments with an obcordate gland covering the base.

* * *Flowers smaller, the lower sometimes sterile: segments of perianth all abruptly contracted to a short glandular claw.*

2. **Z. venenosus,** Watson. Bulb oblong-ovate, rather small (about ½ inch in diameter), with dark outer coats: stem slender, ½ to 2 feet high: leaves narrowly linear, rarely over 2 or 3 lines broad, carinate and usually folded, scabrous at least on the margin, the cauline scarcely or not at all sheathing: raceme simple (very rarely slightly compound at base), short, becoming 4 to 6 inches long or more; bracts foliaceous or membranous, setaceous-acuminate; pedicels slender, 3 to 6 lines or the lower sometimes an inch long, mostly erect in fruit: perianth free from the ovary; segments triangular-ovate to elliptical, 2 or 3 lines long, obtuse or rarely acutish, the blade rounded or subcordate at base: gland extending slightly above the claw and terminated by a well-defined irregular line: stamens equalling the perianth, and somewhat adnate to the claws: ovules 6 to 8 in each cell: capsule 4 to 6 lines long, oblong-ovate, the cells abruptly contracted at the apex: seeds (usually 2 in each cell) 1½ to 2½ lines long. — Proc. Amer. Acad. xiv. 279. *Amianthium Nuttallii,* Gray, and others, as to the plant of the western coast. *Anticlea Nuttallii,* Torr. Pacif. R. Rep. iv. 144, etc. *Z. Nuttallii,* Watson, Bot. King Exp. 343, mainly.

Very frequent in meadows or on stream-banks from Monterey and Mariposa Counties to British Columbia and eastward to the Wahsatch; May to July. The bulb is poisonous and is known among the northern tribes of Indians as "Death-Camass." Dr. Bolander notes, however, that in Sonoma County it is eagerly eaten by the hogs and is hence called "Hogs' Potato" by the farmers of that region. The plant of the Californian Coast Ranges is often stouter than that of the Sierra

Nevada and northward, with the raceme occasionally compound, and the perianth-segments usually with a shorter claw and the blade cordate at base. The species has been confounded with *Z. Nuttallii* of the eastern plains and Texas, which differs in its stouter habit, broader leaves, etc., the perianth-segments not at all unguiculate at base, the free stamens, and the much larger seeds and capsule.

3. **Z. paniculatus,** Watson. Very similar, but usually stouter; the stem from a larger bulb, 1 to 2½ feet high: leaves 3 to 8 lines broad, often all sheathing at base: raceme compound; bracts lax and scarious: flowers of the lower branches of the raceme usually sterile and on short pedicels: perianth-segments about 2 lines long, deltoid, acute or acuminate; gland less definitely margined and often reaching nearly to the middle of the blade: stamens equalling or exceeding the segments: pedicels spreading in fruit: capsule oblong-ovate or oblong, ½ to 1 inch long, the cells attenuate at the apex: seeds 3 to 5 lines long. — Bot. King Exp. 344. *Helonias paniculatus,* Nutt. in Journ. Acad. Philad. vii. 57. *Amianthium Nuttallii,* var., Gray, Ann. Lyc. N. Y. iv. 121.

At Ebbett's Pass (*Brewer*), Chico (*Mrs. J. Bidwell*), and especially frequent on the eastern side of the Sierra Nevada, on dry hillsides and in blossom a month earlier than the last; ranging from Idaho and Nevada to Southern Utah (*Palmer*) and the Saskatchewan. Bulb also poisonous.

29. TOFIELDIA, Hudson. False Asphodel.

Perianth spreading, of 6 distinct greenish white oblanceolate 3-nerved persistent segments. Stamens 6, equalling the segments and inserted at their base; filaments narrowly subulate; anthers round-cordate, attached by the base, dehiscing laterally. Ovary sessile, ovate or somewhat obovate, 3-lobed and 3-celled: styles short, distinct, with small terminal stigmas; ovules several in each cell, attached to the inner angle. Capsule membranous or rigid, obovate, acute, beaked by the persistent spreading styles, septicidal. Seeds several to many in each cell, with thin membranous testa and often tailed. — Herbaceous perennials, with slender running rootstocks and mostly radical equitant linear leaves, the simple stem bearing a short close raceme or spike of small flowers; pedicels not jointed, usually with a small involucre of 2 or 3 more or less united bractlets near the flower.

A genus of about a dozen species, confined chiefly to the northern temperate and arctic zones. The following, with an additional species of the Atlantic States, belong to a subgenus *Triantha,* which is distinguished by having the flowers by threes in a raceme, but developing from above downward, the anthers innate, seeds caudate at one or both ends, and the stem and inflorescence somewhat glandular-pubescent.

1. **T. occidentalis,** Watson. Stem (1 or 2 feet high) and pedicels below the involucres viscid-pubescent: leaves shorter than the stem, 2 lines broad: raceme an inch and pedicels becoming 3 to 5 lines long: involucre a short distance below the flower, 3-lobed nearly to the middle, often reddish: perianth 1½ to 3 lines long: capsule obovate, membranous, 3 or 4 lines long: seeds 6 to 8 in each cell, angular-ovate, with a loose spongy white testa and a slender tail at the outer end about equalling the seed.

Near cold springs in the Red Mountains, Mendocino County (*Kellogg & Harford,* n. 1022) and northward; Mount Hood (*Wood*); Cascade Mountains, Oregon (*Howell*), and near the British boundary, *Lyall.*

2. **T. glutinosa,** Willd. More slender and less tall (6 to 16 inches high): pedicels shorter, with the scarcely lobed involucre near the flower: perianth 1½ or 2 lines long: capsule smaller: seeds numerous, linear, with close thin testa and a long slender contorted tail at each end twice longer than the seed.

Near the Columbia River (*Hall*), in the Cascade Mountains, Oregon (*Howell*), and perhaps ranging southward into N. California. It is the more common American species, found from Sitka and Bear Lake to Maine and Indiana and in the Alleghanies to N. Carolina and Tennessee.

30. NARTHECIUM, Mochring. Bog Asphodel.

Perianth of 6 distinct yellowish-green narrowly lanceolate obscurely 3-nerved segments, reflexed or spreading in flower, soon erect, persistent. Stamens 6, hypogynous, distinct; filaments subulate, woolly; anthers linear, basifixed, introrse. Ovary sessile, linear-oblong, 3-celled and many-ovuled, attenuate upward to the small slightly lobed stigma. Capsule thin-chartaceous, attenuate above, loculicidally 3-valved. Seeds numerous, ascending from very near the base, small and linear, with thin transparent testa, and with a long bristle-like tail at each end. — Stem herbaceous and slender, from a creeping rhizome, with narrowly linear equitant leaves, and flowers in a terminal raceme; pedicels not jointed, bracteolate near the middle.

A genus of four closely allied species, of Europe, E. Asia, the Atlantic States, and California, respectively.

1. **N. Californicum,** Baker. Rootstock slender, with scarious scales at the nodes: stem a foot or two high, much exceeding the mostly basal leaves, which are about 1½ or 2 lines broad and usually 7-nerved; cauline leaves 2 or 3, short: raceme loose, becoming 3 to 5 inches long, 30–40-flowered; pedicels 3 to 6 lines long, twice longer than the linear-lanceolate bracts and bractlets: perianth 3 or 4 lines long, a third longer than the stamens: filaments densely woolly except near the top: capsule exserted; cells 10–15-seeded; seeds a line long, or including the tails 5 lines long. — Journ. Linn. Soc. xv. 351. *N. ossifragum*, var. *occidentale*, Gray, Proc. Amer. Acad. vii. 391.

Swamps on Red Mountain, Mendocino County (*Bolander*, n. 6548; *Kellogg & Harford*, n. 1031); on Downieville Butte, Sierra County, *Lemmon*; Delnorte County, *Rattan*. The ripened capsules are of a bright salmon color.

31. XEROPHYLLUM, Michx.

Perianth white, of 6 distinct spreading oblong-lanceolate several-nerved persistent segments. Stamens at the base; filaments subulate-filiform; anthers rounded, extrorse, dehiscing laterally. Ovary sessile, ovate, 3-lobed; styles distinct, linear, stigmatic on the inner side, reflexed or recoiled, persistent: ovules 1 or 2 pairs in each cell. Capsule chartaceous, loculicidally dehiscent to the base and occasionally also septicidally. Seeds 2 to 4 in each cell, ascending, oblong, somewhat triangular-flattened, with thin longitudinally wrinkled rather light-colored testa. — Perennials, with a short and thick woody tuber-like rootstock, numerous radical elongated very narrowly linear dry striate and serrulate leaves, and a stout simple leafy stem bearing a many-flowered raceme; pedicels slender, not jointed, the bract often borne upon the pedicel and resembling a bractlet.

An American genus of three species, the third confined to the Atlantic States near the coast.

1. **X. tenax,** Nutt. Rootstock an inch thick or more: radical leaves 2 or 3 feet long by about 2 lines broad, flat above and somewhat carinate, rather rigid: stem 2 to 5 feet high, with scattered ascending leaves dilated at base: raceme dense, becoming a foot or two long, the lower bracts foliaceous and serrulate, the upper scarious and often upon the lower part of the pedicel; pedicels an inch or two long, erect in fruit: flowers fragrant; segments 4 or 5 lines long, scarcely equalling the stamens: styles 2 lines long, exceeding the ovary: capsule broadly ovate, acute, nearly 3 lines long, loculicidally 3-valved: seeds narrowly oblong. — *Helonias tenax*, Pursh. *X. setifolium*, Lindl. Bot. Reg. t. 1613, not Michx.

In the Coast Ranges, from Monterey (*Parry*) to British Columbia, sometimes occupying extensive meadows; also in the northern Sierra Nevada (Plumas County, *Lemmon*, *Mrs. Austin*).

X. Douglasii, Watson, found in the mountains from the Columbia to Montana, is a similar species with a narrower raceme of smaller flowers; stamens included; styles a line long; capsule cordate-ovate, 2 lines long, the very abruptly acute cells usually separating and then dehiscing loculicidally; seeds shorter and broader.

Order CIX. SMILACEÆ.

Shrubby (or rarely herbaceous) plants, climbing by petiolar tendrils, often prickly, the leaves net-veined between the nerves, with small diœcious greenish usually 6-parted flowers; perianth regular, deciduous; stamens at the base of the segments, with introrse basifixed 1-celled anthers; ovary superior, 3-celled (rarely 1- or several-celled), with as many sessile linear spreading stigmas, and 1 or 2 suspended orthotropous ovules in each cell; fruit a berry; seeds with minute embryo, the testa closely adherent to the horny albumen. — Rootstocks often elongated or tuberous; leaves alternate, petiolate, the petiole usually bearing a pair of opposite tendrils above the dilated clasping base; flowers in axillary pedunculate umbels or racemes. Represented almost solely by the following genus.

1. SMILAX, Tourn. Green Brier.

Characters as of the order. Flowers in umbels. Anthers bilocellate.

A widely distributed genus of 150 species or more, chiefly of the tropical and temperate regions of Asia and America. A dozen species are found in the Atlantic States. The single representative of the genus in California belongs to the section *Eusmilax*, having solitary ovules, and the perianth-segments of the male flowers recurved. The roots of many species are employed in medicine under the name of Sarsaparilla.

1. **S. Californica,** Gray in herb. Glabrous; stem woody, terete or somewhat angled, naked or covered with weak spreading prickles (becoming black): leaves broadly ovate, abruptly acute, somewhat cordate at base, 1½ to 4 inches long, thin and deciduous, roughish on the margin: peduncles slender, flat, 2 or 3 times longer than the petioles, which are about an inch long: flowers few to many (20 or less); segments (4 to 6) green, narrowly oblong, 2 lines long: fruit black, 3 lines in diameter. — *S. rotundifolia* (!), Benth. Pl. Hartw. 341. *S. rotundifolia*, var. *Californica*, A. DC. Monog. Phaner. i. 75.

On the Upper Sacramento, near Chico (*Hartweg*, and others); on McCloud's River, in fruit, *Lemmon*. Near *S. hispida* of the Atlantic States, but leaves less acuminate and more cordate.

Order CX. PONTEDERIACEÆ.

Perennial aquatic herbs, with spathaceous perfect flowers, an irregular funnelform or nearly regular and salverform 6-cleft persistent perianth, 6 or 3 perigynous more or less unequal or dissimilar stamens with introrse anthers attached near the base, a superior sessile 1–3-celled 1–many-ovuled ovary, and a simple style; fruit a many-seeded 3-celled (or 1-celled with 3 parietal placentæ) membranous 3-valved capsule, or a (by abortion) 1-celled 1-seeded utricle; seed anatropous, with farinaceous albumen, and straight axile embryo. — Stems from creeping rootstocks, with alternate sheathing or clasping leaves, and spicate or axillary and sessile solitary flowers.

An order of 7 genera and 20 or more species, mostly of the tropical and temperate regions of America, rare in tropical Africa and Asia. In the Atlantic States there are a single species of *Pontederia* (the principal genus), and two of *Heteranthera*, besides the following.

1. SCHOLLERA, Schreber. Water Star-grass.

Perianth salverform, with elongated filiform tube and 6-parted limb, the segments linear-lanceolate and nearly equal. Stamens 3, on the throat opposite the inner segments, equal; filaments subulate; anthers linear to oblong. Ovary oblong, 1-celled, with 3 parietal placentæ; style exserted, clavate above, slightly 3-lobed: ovules many, alternate in 2 rows on the placentæ: capsule membranous, oblong, enclosed in the withered base of the perianth, 3-valved. Seeds oblong, striate. — Stems submersed, from slender creeping rootstocks, slender and branching, with linear grass-like leaves, and axillary solitary yellowish flowers, which alone reach the surface. A single species.

1. **S. graminifolia,** Willd. Stem becoming several feet long: leaves 1 to 3 inches long and a line or two wide, clasping at base, obtuse: spathe herbaceous with a short foliaceous apex: perianth tube 1 to 3 inches long, the segments of the limb spreading, 3 or 4 lines long: capsule torulose, 3 or 4 lines long, 8 – 15-seeded. — Nov. Act. Soc. Berl. iii. 438. *Leptanthus gramineus,* Michx. Fl. i. 25, t. 5, fig. 2; Hook. Exot. Fl. t. 94. *Heteranthera graminea,* Vahl, Enum. ii. 45; Torrey, Fl. N. York, ii. 313, t. 133.

Common in streams in most of the Atlantic States from Canada to Texas; more rare westward. In Mendocino County (*G. R. Vasey*); Willamette River, Oregon, *Howell.* A low terrestrial form sometimes occurs, growing on muddy shores.

Order CXI. ARACEÆ.

Perennial glabrous herbs, with large radical or alternate leaves, and perfect or usually monœcious or dicœcious flowers sessile and crowded on a spadix, which is surrounded by a simple spathe; perianth none, or 4 – 6-sepaled in perfect flowers; fruit a berry, 1 – 4-celled, 1 – many-seeded: seeds mostly albuminous, minute.

A large order, but mostly tropical and scarcely represented in California. About half a dozen species, of nearly as many genera, are found in the Atlantic States and northward.

1. LYSICHITON, Schott.

Spathe sheathing at base, with a broad colored lamina or none, at first enveloping the cylindrical spadix, which becomes long-exserted upon a stout peduncle. Flowers perfect, crowded and covering the spadix, with 4-lobed perianth, and 4 stamens opposite the segments. Filaments short, flat; anthers 2-celled, opening upward. Ovary conical, 2-celled, 2-ovuled: stigma depressed: ovules horizontal, orthotropous. Fruit fleshy, somewhat immersed in the rhachis and coalescent.— Acaulescent swamp herbs, with large leaves from a thick horizontal rootstock. A single Japanese species besides the following.

1. **L. Kamtschatcensis,** Schott. Leaves (1 to 2½ feet long and 3 to 10 inches broad) oblong-lanceolate, acute, narrowed to a short petiole or sessile: spathe with a broad acute blade: peduncle very stout, shorter than the leaves (becoming 6 to 12 inches long): spadix broader, 3 or 4 inches long. — Prodr. Aroid. 421; Rothrock in Smithson. Rep. 1867, 455. *Arctiodracon Camtschaticum,* Gray, Smithson. Contrib. n. ser. ix. 409.

Common in swamps near Fort Bragg, Mendocino County (*Bolander*), and near Humboldt Bay (*Rattan*), ranging northward to Sitka and also found in Kamtschatka. May and June, in flower. Resembling the *Symplocarpus fœtidus,* or Skunk Cabbage, of the Eastern States.

Order CXII. TYPHACEÆ.

Aquatic perennial herbs, with creeping rootstocks, cylindric solid stems, alternate linear entire sessile leaves, and monœcious flowers in heads or on a spadix, without perianth, the upper spikes staminiferous; stamens and ovaries intermixed with bristles or scales; anthers linear, longitudinally dehiscent; ovaries 1–2-celled, 1-ovuled, with a slender style and 1-sided stigmas, becoming dry and nut-like; seeds pendulous, anatropous, with copious albumen and a straight axile embryo. — Only two genera, scarcely reaching California.

1. **Sparganium**. Flowers in globular heads with foliaceous bracts.
2. **Typha**. Flowers in a cylindrical compact terminal spike: spathe-like bract deciduous.

1. SPARGANIUM, Tourn. Bur-reed.

Flowers in dense separate globose heads on a leafy-bracted simple or branching spadix, the upper heads staminate. Stamens with slender elongated filaments, mingled with minute scales. Ovaries sessile, 1–2-celled, surrounded by 3 to 6 very narrowly linear-subulate scales. Fruit indehiscent, wedge-shaped or clavate. Seed ovoid, smooth.

Four or five species are widely distributed through the cold and temperate regions of the northern hemisphere.

1. **S. simplex**, Hudson. Stem erect, a foot high or more, rather slender, with simple inflorescence: leaves triangular or flattened, exceeding the stem (often 2 or 3 feet long, and as many lines broad): heads 2 to 4 of each kind, the lower often above the axils, and sessile or pedunculate; the sterile very small: stigmas single, linear or oblong: fruit nearly terete, attenuate at each end, 3 or 4 lines long including the linear style: scales half as long. — Reichenb. Icon. Fl. Germ. ix. t. 325.

In the Sierra Nevada from Mono Pass to Oregon and northward, and eastward across the continent; also European. Several varieties are described. July to September.

2. **S. eurycarpum**, Engelm. Erect, stout, 2 to 4 feet high, with branching inflorescence: leaves mostly flat: heads 2 to 6 or more: fruit sessile, wedge-shaped and many-angled, 3 or 4 lines long, with a broad depressed summit ($2\frac{1}{2}$ to $3\frac{1}{2}$ lines wide), abruptly tipped with the short style. — Gray, Manual, 481.

In the Humboldt River, Nevada (*Watson*), and northward, and eastward across the continent.

2. TYPHA, Tourn. Cat-tail Flag.

Flowers in a dense cylindrical terminal spike. Stamens with very short connate filaments, mixed with numerous long hairs. Ovaries long-stipitate, 1-celled, surrounded by numerous bristles and clavate rudimentary ovaries. Styles filiform. Fruit minute, usually splitting on one side. Seed linear, striate. — The staminate and pistillate portions of the spike are either contiguous or separate, naked or subtended by a spathe-like deciduous bract.

A genus of about 9 species, distributed through the tropical and temperate regions of the globe. The roots are farinaceous, and the tough flat leaves are used for various domestic purposes.

1. **T. latifolia**, Linn. Stout and tall, 4 to 6 feet high, the flat sheathing leaves 3 to 6 lines broad or more, exceeding the stem: pistillate and staminate parts of the spike each 3 to 6 inches long, usually contiguous, the pistillate dark brown with the crowded rhombic-lanceolate stigmas, and at length an inch in diameter; pistil-

late flowers without bracts: pollen-grains in fours. — Rohrbach, Verh. Ver. Brandenb. xi. 38, and Amer. Journ. Sci. 3 ser. ii. 375; Reichenb. Icon. Fl. Germ. ix. t. 323.

Common in marshes from the Sacramento northward, and found throughout most of North America, and in the Old World.

2. **T. angustifolia,** Linn. Leaves usually narrower, somewhat convex on the back: pistillate and staminate inflorescence usually separated by a short interval, the spike becoming 5 or 6 lines in diameter: pollen-grains simple: pistillate flowers with a linear stigma, and a hair-like bract slightly dilated at the summit. — Rohrbach, l. c.; Reichenb. l. c., t. 321.

Collected at Soda Lake in Southeastern California (*Dr. Cooper*) and at Los Angeles (*Rev. J. C. Nevin*); also in the Atlantic States, but less common than the last, and in the Old World.

Order CXIII. LEMNACEÆ.

Very small floating herbaceous perennial stemless plants, consisting of flattened disk-like fronds, with usually one or more rootlets from the middle below; florets imbedded in the frond, without perianth, naked or bracteate, with 1 or 2 stamens and a sessile 1-celled 1 – several-ovuled ovary (each organ by some botanists considered a distinct flower); style simple, with funnelform stigma; ovules at the base of the cell; fruit a utricle; seeds comparatively large, albuminous with straight axile embryo, the testa operculate at the apex. — Hegelmaier, Die Lemnaceen.

Comprising only three genera and perhaps 20 species, found on still waters in temperate and tropical regions. The smallest of all flowering plants, rarely found in flower or fruit, propagating by buds from lateral or basal slits, the young fronds at length separating. In autumn the buds or bulblets sink into the mud, to rise again in the spring. Only one genus is positively known as Californian, but both the others will probably be found. The third genus, *Wolffia*, is distinguished by its minute size, the thick rootless fronds being only ¼ to ¾ of a line broad. The flowers are naked, and have a single stamen with a 2-celled anther, and a 1-ovuled ovary.

1. **Lemna.** Frond 1 – 5-nerved, with a single rootlet.
2. **Spirodela.** Frond 7 – 11-nerved, with several rootlets.

1. LEMNA, Linn. Duckweed. Duck's-meat.

Flowers marginal, bracteate, diandrous. Filaments slender; anthers didymous, each cell bilocellate by a transverse partition, dehiscing transversely. Seeds 1 to 6, mostly ribbed. — Frond 1 – 5-nerved, containing numerous acicular raphides, proliferous from a lateral slit (usually on each side) near the base, with a single rootlet, which is destitute of vascular tissue.

* *Ovule solitary, orthotropous or nearly so: frond* 1 – 3*-nerved, thin.* — Lemna proper.

+ *Fronds oblong, stalked at base, remaining connected.*

1. **L. trisulca,** Linn. Fronds thin, oblong or oblong-lanceolate, 6 to 9 lines long, attenuate at base into a slender stalk, very obscurely 3-nerved, often without rootlets, usually several series of offshoots remaining connected: bract sac-like: seeds ovate, amphitropous, with small round operculum. — Hegelm. l. c. 134, t. 5, 6; Reichenb. Icon. Fl. Germ. vii. 9, t. 15.

Near San Francisco and on San Gabriel Creek (*Bigelow*); Plumas County (*Lemmon*); Oregon, and eastward through most of North America, as also through Europe, Asia and Australia.

+ + *Fronds oblong to elliptical or round-ovate, sessile, soon separating.*

2. **L. Valdiviana,** Philippi. Fronds elliptic-oblong, small (a line long or usually less, rarely more), rather thick, obscurely 1-nerved: bract broad-reniform:

seed orthotropous, oblong, with a prominent acute operculum. — Linnæa, xxxiii. 239; Hegelm. l. c. 136, t. 7, fig. 1–8, and Fl. Bras. fasc. 76, t. 1, fig. iv. *L. Torreyi*, Austin; Gray, Manual, 479.

In springs, Lake County (*Bolander*); about San Francisco (*Bolander, Kellogg & Harford*); Los Angeles (*Brewer*); Northern Nevada (*Watson*); Arizona (*Palmer*), and eastward to the Atlantic; also South American.

3. **L. minor**, Linn. Fronds round- to elliptic-obovate, 1 to 2½ lines in diameter, rather thick, very obscurely 3-nerved: bract sac-like: seed oblong-obovate, amphitropous, with prominent rounded operculum. — Nees, Gen. iii. t. 42; Hegelm. l. c. 112, t. 9, 10; Reichenb. l. c. 8, t. 14.

Reported from various localities in California (Lobos Creek, *Bolander*, etc.), and common in all quarters of the globe — the most widely distributed of all the species, and usually abundant, closely covering the surface of stagnant pools.

L. PAUCICOSTATA, Hegelm., may perhaps also be found in California, resembling *L. minor*, but with orthotropous seed, and the sheaths at the base of the young roots with broad wing-like appendages; bract reniform; frond with a minute dorsal spine near the apex.

* * *Ovules 2 to 7, anatropous: fronds very thick and spongy, flat above, very obscurely 5-nerved.* — TELMATOPHACE, Hegelm.

4. **L. gibba**, Linn. Fronds obovate-elliptic to nearly orbicular, almost hemispherical, soon separating: bract sac-like. — Hegelm. l. c. 145, t. 11–13; Reichenb. l. c.

Near San Francisco (*Bolander*, in flower); Santa Barbara (*Torrey*); Arizona (*Palmer*); in the Atlantic States, but rather rare; in Mexico, the West Indies, and all quarters of the Old World. A very peculiar and easily recognized species.

2. SPEIRODELA, Schleiden.

Anther-cells bilocellate by a vertical partition and dehiscent longitudinally. Ovary 2-ovuled. Frond 7–11-nerved or more; rootlets several, with axile vascular tissue. Otherwise nearly as *Lemna*. — A single species.

1. **S. polyrrhiza**, Schleid. Fronds round-obovate, purple beneath, 2 to 4 lines in diameter, distinctly about 7-nerved; roots clustered, usually 3 to 5: bract sac-like: ovules amphitropous. — Hegelm. l. c. 147, t. 16, and Fl. Bras. l. c. fig. vi.; Austin, Torr. Bot. Bull. i. 37, figs.; Engelm. same, i. 42. *Lemna polyrrhiza*, Linn.; Reichenb. l. c., t. 15.

Truckee River, Nevada (*Watson*); Oregon (*Hall*); and found in all quarters of the globe, but not yet reported from within the limits of California. It is very rarely detected in flower or fruit, though often very abundant.

ORDER CXIV. NAIADACEÆ.

Marsh or mostly immersed aquatic herbs, with stems jointed and leafy or (in *Triglochin*) naked and scape-like, leaves sheathing at base or stipulate, and flowers perfect or unisexual, often spathaceous, with perianth of 4 or 6 herbaceous distinct valvate segments, or membranous and tubular or cup-shaped, or none; stamens 1, 2, 4 or 6, with extrorse anthers; ovaries 1 to 6, distinct or more or less coherent, 1-celled, usually 1-ovuled, in fruit follicular or capsular or an indehiscent berry or utricle; albumen none; embryo large, often curved.

An order (as here understood, embracing the *Juncaginew*) of about 20 genera and 70 or more species, widely distributed chiefly through temperate and cooler regions, both in fresh and saline waters. There is much diversity in the characters of the genera. With few exceptions the Californian species are the same as those on the Atlantic coast, and are also found in the Old World.

* Immersed aquatics, with flat linear leaves : ovaries solitary or distinct, 1-ovuled. — NAIADEÆ.

\+ Perianth none, or membranous and cup-shaped.

\+\+ Flowers monœcious or diœcious : ovary 1, sessile : stamen 1 (where known).

1. **Naias.** Flowers diœcious, solitary or clustered, axillary. Perianth none in fertile flowers, cup-shaped and membranous in the staminate. Style with 2 to 4 awl-shaped stigmas. Stems floating, with opposite or ternate leaves.
2. **Zostera.** Naked ovaries and stamens alternate in 2 vertical rows on the inner side of a margined leaf-like enclosed spadix ; ovaries pendulous. Stigmas 2, linear. Stem creeping.
3. **Phyllospadix.** Ovaries naked, alternate in 2 rows on the inner side of a margined foliaceously appendaged enclosed spadix, ascending. Stigmas 2, linear, sessile.
4. **Lilæa.** Fertile flowers in an exserted slender spike. Stigma capitate.

\+\+ \+\+ Ovaries about 4, nearly sessile, becoming more or less stipitate.

5. **Zannichellia.** Flowers monœcious, axillary, sessile or nearly so. Stamen 1, naked ; filament slender. Fertile flowers solitary, with a cup-shaped membranous spathe or perianth. Stigmas peltate. Leaves opposite.
6. **Ruppia.** Flowers perfect, 2 or more on an enclosed spadix, at length long-exserted, without perianth. Anthers 2, sessile, the cells distinct. Stigma depressed. Leaves alternate.

\+ \+ Flowers perfect, with herbaceous 4-sepaled perianth, in a peduncled spike.

7. **Potamogeton.** Ovaries and anthers 4, sessile. Stigma sessile, unilateral.

* * Marsh plants with terete bladeless leaves : flowers perfect, spicate or racemose, with herbaceous 6-lobed perianth : carpels 3 or 6, more or less united, separating at maturity : seed erect or ascending, anatropous, with straight embryo. — JUNCAGINEÆ.

8. **Triglochin.** Ovaries 3 to 6, united until maturity. Leaves radical. Flowers bractless, in a spike-like raceme terminating a jointless scape.
9. **Scheuchzeria.** Ovaries 3, nearly distinct, at length divergent. Flowers bracteate in a loose raceme upon a leafy stem.

1. NAIAS, Linn. NAIAD.

Flowers mostly diœcious, axillary, solitary or clustered, sessile. Male flower of a single stamen and a membranous tubular 4-lobed perianth within a small cup-shaped membranous spathe ; anther 4-celled, nearly sessile : pollen granular. Fertile flowers without perianth or spathe, the oblong ovary terminated by a short style and 2 to 4 narrowly subulate stigmas. Fruit a very thin membranous utricle, filled by the single erect anatropous seed. Outer testa subcrustaceous. Embryo straight, entire, with the minute plumule near the upper end. — Slender immersed aquatics, with jointed branching floating stems, and opposite or verticillate (often crowded) linear toothed leaves, sessile and somewhat dilated at base.

Ten or twelve species are known, four of which are found in the Atlantic States.

1. **N. major,** Allione. Stem rather stout and often armed with broad prickles : leaves broadly linear, 3 to 18 lines long, coarsely and sharply toothed, the dilated base entire : fruit 2 to 2½ lines long : seed very finely lineate, oblong, slightly compressed. — Nees, Gen. t. 44.

In Clear Lake (*Bolander*) ; Huntington Valley, Nevada (*Wheeler*) ; Santa Cruz River, Arizona (*Dr. Smart*) ; Utah, *Parry.* It is also found in the salt springs of New York, in Europe, the West Indies, and the Sandwich Islands.

2. **N. flexilis,** Rostk. & Schmidt. Stems very slender : leaves very narrowly linear, a half to an inch long, very minutely serrulate : fruit 1½ lines long, narrowly oblong. — *N. Canadensis,* Michx. ; Hook. Fl. Bor.-Am. ii. 170, t. 184.

Near San Francisco (*Chamisso*) ; Clear Lake (*Bolander*) ; Washington Territory (*Lyall*) ; common in the Atlantic States, and found in Mexico, the West Indies, and Europe.

2. ZOSTERA, Linn. EEL-GRASS. GRASS-WRACK.

Flowers monœcious and without perianth, the single stamens and ovaries arranged alternately in 2 rows upon the face of a linear-oblong leaf-like sessile spadix en-

closed in the dilated membranous base of a leaf. Anther 1-celled, sessile; pollen thread-like. Ovary attached near its apex, beaked by a short style, with 2 linear deciduous stigmas, and a single pendulous orthotropous ovule. Fruit utricular, oblong. Seed with suberustaceous testa. Embryo split longitudinally and enclosing the long linear curved plumule. — Stout submersed marine perennial herbs, with creeping and rooting stems or rootstock, and alternate elongated grass-like ribbon-shaped entire leaves.

Only 4 species, two of them peculiar to Australia and one to the Old World.

1. **Z. marina**, Linn. Stems rather fleshy, often elongated: leaves with long sheathing bases, 3–7-nerved, obtuse, one to several feet in length, 2 to 4 lines broad; fruiting leaves jointed at the base of the spathe, which terminates with a more or less elongated leaf-like summit: spadix 2 to 4 inches long, 10–20-fruited, without appendages: seed thick-oblong, 1½ lines long, longitudinally striate. — Nees, Gen. iii. t. 42; Reichenb. Icon. Fl. Germ. vii. t. 4.

Common in the shoal water of bays, etc., below low-water mark, from Alaska to Oregon, and probably farther southward; also on the Aretic and North Atlantic coasts, the shores of Europe, and of northeastern Asia. The smaller form (var. *angustifolia*, Hornem.; *Z. angustifolia*, Reichenb. l. c., t. 3), with narrow 1-nerved leaves, is also reported from Alaska.

3. PHYLLOSPADIX, Hook.

Flowers diœcious (?), the staminate unknown. Ovaries without perianth, sessile in two vertical rows alternately upon the face of a submembranous broadly linear sessile spadix, which is enclosed in the dilated membranous base of a leaf-like spathe and has within the margin on each side a series of short dilated foliaceous appendages as many as the ovaries; attachment of the ascending ovaries above the base: stigmas 2, linear, sessile, deciduous. Ovule pendulous, orthotropous. Fruit coriaceous, indehiscent. Embryo straight, entire, somewhat pitted on one side. — Perennial submerged marine herbs, with thick rootstocks, slender stems, and elongated linear leaves.

Only the following species, peculiar to the western coast.

1. **P. Torreyi**, Watson. Stem slender, and leaves much elongated (3 to 6 feet), less than a line wide, with very long sheaths (2 to 10 inches), flat, faintly 1-nerved, coriaceous: peduncles short, broad and somewhat channelled, one or two axillary at each joint of the stem: the dilated portion of the spathe 1½ to 2 inches long, leaf-like above: the enclosed spadix 1½ lines wide; appendages ovate-oblong, acute, 2½ to 3 lines long, within the margin of the spadix and above the attachment of the corresponding ovaries: ovaries 15 to 20 or more, cordate-sagittate and somewhat dorsally flattened and carinate, 2½ lines long; stigmas half as long. — Proc. Amer. Acad. xiv. 303.

Collected at Santa Barbara, in flower (*Dr. Torrey*), and with immature fruit, *Miss S. A. Plummer*. The fruiting specimen described and figured by Ruprecht (Mém. Acad. Pétersb. vii. 58, t. 1, and 2, figs. 5–16) under the name of *P. Scouleri*, from the mouth of Russian River, would seem from the shape of the fruit to be probably this species, though it is represented as having the peduncles short, with a single spathe, and the leaves broader. Only one or two ripe fruits were found by him, and none other have hitherto been collected.

2. **P. Scouleri**, Hook. Very similar to the last, but stems short, peduncles short and with a single spathe, leaves broader (2 lines wide) and 3-nerved; and ovaries ovate-oblong, rounded at base: fruit unknown. — Fl. Bor.-Am. ii. 171, t. 186; Ruprecht, l. c. in part, t. 2, figs. 1–4.

Dundas Island, in the Columbia River (*Scouler*); Vancouver's Island (*Lyall*); apparently also with the last at mouth of Russian River, *Wosnessenski*.

4. LILÆA, HBK.

Flowers monœcious, without perianth. Male flowers mingled with the pistillate or in distinct spikes, of a single nearly sessile 2-celled rounded anther subtended by a hyaline bract. Ovaries naked, sessile and erect, in the axils of radical leaves and in pedunculate exserted spikes, the upper with short styles, but the lower styles much elongated; stigmas capitate; ovules solitary, erect. Fruit coriaceous, oblong-lanceolate, indehiscent, compressed and ribbed, the upper narrowly winged, the lower wingless and laterally toothed at the summit. Seed with membranous testa and straight narrow and entire embryo. — An aquatic or marsh annual (?) herb, with fibrous roots and radical grass-like leaves sheathing at base. Only the following species. — *Heterostylus*, Hook.

1. **L. subulata**, HBK. Leaves ½ to 1 foot long or more, a line or two broad, several-nerved, thin: spikes crowded, a half to an inch long, on peduncles shorter than the leaves: staminate bracts narrowly oblong, obtuse, half a line long, twice longer than the anther: radical fruits 3 lines long, the filiform style often 1 to 3 inches long; upper fruits elliptical, acute, somewhat smaller. — Nov. Gen. i. 222, t. 63. *Heterostylus gramineus*, Hook. Fl. Bor.-Am. ii. 171, t. 185.

School Station, near San Francisco (*Kellogg*); in ponds near Searsville, San Mateo County (*Bolander*); on the Columbia River, *Scouler*. Apparently not distinct from the Chilian plant on which the species was founded, though usually larger. The Searsville specimens are especially well developed, being 2 feet high or more and the fruiting spikes 1½ inches long.

5. ZANNICHELLIA, Micheli. Horned Pondweed.

Flowers monœcious, axillary, sessile or nearly so. Male flowers of a single naked stamen, with elongated filament and 2-celled anther. Fertile flowers usually in the same axils, of 2 to 5 sessile or shortly stipitate ovaries in a membranous cup-shaped perianth or spathe; style short; stigma peltate; ovule solitary, suspended, orthotropous. Fruit an obliquely oblong coriaceous nutlet, somewhat compressed, beaked. Seed with membranous testa. Embryo slender, the attenuate cotyledonary end bent into a coil. — Very slender immersed branching aquatics, with very narrow and filiform flattened mostly opposite leaves, not sheathing, and with small free membranous stipules. Several species are described, perhaps all varieties of a single one.

1. **Z. palustris**, Linn. Stems 2 inches to 2 feet long or more, branching and leafy: leaves ½ to 2 or 3 inches long: fruit somewhat incurved, often more or less toothed on the back, 1 to 1½ lines long, about twice longer than the style, usually becoming shortly stipitate and frequently also pedunculate. — *Z. major*, Bönn.; Nees, Gen. iii, t. 46; Reichenb. Icon. Fl. Germ. vii. 9, t. 16.

In fresh-water ponds and slow streams; collected in California by *Douglas*, in springs at the base of Monte Diablo (*Brewer*), in ditches on Oakland Hills (*Bolander*), and near Santa Barbara (*Mrs. Elwood Cooper*); found also in Utah and New Mexico, in the Atlantic States, and in most quarters of the globe, excepting South America and Africa.

6. RUPPIA, Linn. Ditch-grass.

Flowers perfect, without perianth, 2 or more approximate on a spadix enclosed in the sheathing base of a leaf, becoming long-exserted. Anthers 2, sessile, of 2 distinct cells, transversely dehiscent. Ovaries 4, at first sessile, with nearly sessile depressed stigmas, and solitary suspended campylotropous ovules. Fruit obliquely

ovoid, very shortly beaked, on elongated slender stipes, hard and drupe-like. Seed with membranous testa. Embryo ovoid, with a short cotyledon and short lateral plumule. — Very slender branching herbs, growing in salt or brackish water, with filiform or capillary alternate leaves, broadly sheathing at base. A single variable species.

1. **R. maritima,** Linn. Stems elongated, filiform, a foot or two long or more, leafy : leaves 2 to 4 inches long, with usually broadly dilated bases : flowers 2 to 6 or 8 in a short close spike : fruiting peduncles mostly very long (3 to 6 inches) and contorted : fruit 1½ lines long, the stipes 1 or 2 lines or often 6 to 12 lines long. — Nees, Gen. iii, t. 47 ; Reichenb. Icon. Fl. Germ. vii. 10, t. 17.

Near Santa Barbara (*Mrs. Elwood Cooper*) ; in Clear Lake (*Bolander*) ; Russian River (*Rattan*) ; Oregon and Washington Territory, on the Atlantic Coast, and in all quarters of the globe, excepting perhaps South America.

7. POTAMOGETON, Tourn.* Pondweed.

Flowers perfect, in peduncled axillary spikes, with herbaceous perianth of 4 rounded valvate segments, 4 stamens opposite to the segments, and usually 4 sessile ovaries. Anthers 2-celled, nearly sessile. Ovaries with oblique depressed nearly sessile stigmas, and solitary ascending campylotropous ovules. Fruit somewhat compressed, ovate, drupe-like, with a crustaceous nutlet within. Seed with membranous testa and strongly curved or spiral embryo. — Slender jointed and branching submerged perennial aquatics, of fresh or brackish water, with mostly alternate linear or dilated (often dimorphous) leaves, and scarious stipules, free and axillary or united to the base of the leaf. Spikes enclosed in the bud, at length long-exserted.

The largest genus of the order, of about 40 species, many of them widely distributed around the globe. Of the 24 North American species one-half are peculiar to the continent. Mature fruit is in most cases necessary for their positive determination.

Floating leaves thick, dilated : stipules free : spikes dense.
- Submerged leaves mostly narrowly grass-like or filiform.
  - Floating leaves subcordate, mostly shorter than the petioles, the submerged very narrow and elongated : stipules long and conspicuous : spike long : embryo nearly circular. — 1. P. NATANS.
  - Floating leaves attenuate at base, on short petioles, the submerged linear : stipules short, deciduous : spike 1 inch long or less : embryo spiral. — 2. P. CLAYTONI.
- Submerged leaves lanceolate, rarely oval or linear.
  - Floating leaves 10–20-nerved ; the submerged narrow.
    - Floating leaves attenuate to a very short petiole ; the submerged narrowly oblong-lanceolate, sessile : fruit beaked. — 3. P. RUFESCENS.
    - Floating leaves abruptly narrowed to a long petiole ; submerged linear-lanceolate, often elongated, the lower sessile : fruit acute. — 4. P. LONCHITES.
    - Floating leaves small, rounded or cuneate at base, on slender petioles ; submerged linear-lanceolate, short, attenuate to a sessile base : fruit small. — 5. P. GRAMINEUS.
  - Floating leaves 30–50-nerved ; the submerged large, falcate, undulate, petiolate : fruit large. — 6. P. AMPLIFOLIUS.

Leaves all submerged, numerous, lanceolate to oval, mostly sessile : spikes dense, on stout peduncles.
- Leaves oblong-lanceolate, acute or acuminate, attenuate to a very short petiole : fruit rounded, acute. — 7. P. LUCENS.

* The determinations of the Californian species, and to some extent the following descriptions, are from the notes of the late Dr. J. W. Robbins, who carefully studied most of the material that has been collected and at the time of his death had done much toward a revision of the western species.

Stem stout, flexuous above : leaves lanceolate, obtuse, cucullate at the apex, rounded and sessile at base : fruit large, semicircular, beaked. 8. P. PRÆLONGUS.
Stem slender, straight : leaves lanceolate, acuminate, clasping : stipules small : fruit nearly orbicular. 9. P. PERFOLIATUS.
Leaves all submerged, sessile, narrowly linear or setaceous.
Stipules free from the narrow base of the leaf.
Spike linear-cylindric.
Stem flattened : leaves grass-like, 3-nerved, clasping : stipules conspicuous : peduncle longer than the spike : fruit large. 10. P. ZOSTERÆFOLIUS.
Spike capitate (or interrupted in n. 13) : stems very slender.
Leaves very narrow, 1 or 2 inches long, 1 – 3-nerved, narrowed at base : peduncles very short : fruit small, undulate-carinate. 11. P. PAUCIFLORUS.
Leaves larger, 2 or 3 inches long by a line wide or less, 3 – 5-nerved. 12. P. NIAGARENSIS.
Leaves narrowly linear, 1 or 2 inches long, sessile, 1 – 5-nerved : peduncles long, slender : fruit more obscurely keeled. 13. P. PUSILLUS.
Stipules united with the sheathing base of the leaf : spikes interrupted.
Stem filiform : leaves very narrowly linear or setaceous, 2 to 6 inches long, 1 – 5-nerved : peduncles long : fruit large, acute. 14. P. PECTINATUS.
Similar : leaves setaceous : peduncles usually short : fruit small, tipped with the broad stigma. 15. P. MARINUS.
Stem stouter : leaves many, distichous, linear-lanceolate, shorter, many-nerved : peduncles short, stout : fruit large, keeled, acutely beaked. 16. P. ROBBINSII.

* *Floating leaves more or less coriaceous, with a dilated petioled blade (the uppermost approximate and often opposite), different in form from the thinner submerged ones; stipules free : spikes cylindrical, mostly dense, not interrupted.*

+– *The submerged leaves reduced to narrowly grass-like or filiform sessile phyllodia.*

1. **P. natans,** Linn. Stem rather stout, simple or sparingly branched : floating leaves thick, ovate-elliptic to lanceolate, acutish, slightly cordate at base, 21 – 29-nerved, usually 2 or 3 inches long, mostly shorter than the petiole ; stipules long and conspicuous, acute or acuminate ; upper submerged leaves with a small lanceolate blade, the lower (only formed early or late in the season) reduced to very narrow thickish elongated phyllodia : peduncle stout, bearing an emersed spike 1½ or 2 inches long : fruit turgid, obliquely obovate, acute, 2 lines long : nutlet with a small deep pit on each side : embryo nearly circular. — Reichenb. Icon. Fl. Germ. vii. 26, t. 50.

In ponds and ditches ; Plumas County (*Mrs. Austin*) and northward to Washington Territory (*Lyall, Hall, Howell*) and Sitka, in Northern Nevada and Utah (*Watson*), and common eastward ; also European and Asiatic. Fruit maturing in August and September ; in deeper or flowing water the plant becomes more slender and often wholly submerged.

2. **P. Claytoni,** Tuckerman. Stem compressed, from creeping rootstocks : floating leaves narrowly oblong to elliptic, 11 – 17-nerved, obtuse or acutish, attenuate below into a flattened petiole usually shorter than the (1 to 2½ inches long) blade ; stipules sheathing, soon deciduous, an inch long or less ; submerged leaves very thin, linear (2 to 5 inches long by 1 to 2½ lines wide), 5-nerved, with a close cellular reticulation between the middle nerves : spikes ½ to 1 inch long, on short stout peduncles : fruit obovate, 3-keeled, slightly apiculate, 1½ lines long or less : nutlet slightly depressed on the sides : embryo spirally incurved, forming about 1½ coils. — Amer. Journ. Sci. xlv. 38, and 2 ser. vi. 227.

In still or flowing water ; Yosemite Valley (*Bolander*) ; Columbia Valley (*Hall, Howell*) ; common in the Atlantic States.

+– +– *Submerged leaves lanceolate, rarely oval or linear.*

3. **P. rufescens,** Schrad. Floating leaves (often wanting) rather thin, 11 – 17-nerved, narrowly oblong-elliptic or oblanceolate, 2 to 4 inches long, acutish, attenu-

ate into a very broad short petiole; stipules broad, usually acuminate, ½ to 1 inch long or more; submerged leaves as large as the floating ones, sessile or nearly so, mostly alternate, narrowly oblong-lanceolate (3 to 6 lines broad), obtuse or acute, the midrib bordered by rows of narrow longitudinal cells: spikes 1 or 2 inches long, rather slender, on stout often elongated peduncles: fruit round-obovate, 1½ lines long, compressed, acutely margined, beaked by the rather long style: nutlet pitted on each side: embryo nearly circular. — Reichenb. l. c., t. 32.

In streams or ponds; collected only in Silver Valley, Alpine County (*Brewer*); found also in Montana and Colorado (*Richardson, Jones*), and common in the Atlantic States, from New England to Texas, as well as in Europe.

4. **P. lonchites**, Tuckerman. Stem rather slender, branching: floating leaves thickish, 11–23-nerved, long-elliptical to oblong-lanceolate, usually 2 to 4 inches long by 9 to 15 lines wide, acute or acutish, rather abruptly narrowed into a petiole usually longer than the blade; submerged leaves thinner, mostly linear-lanceolate, 3 to 12 inches long by 2 to 12 lines broad, more attenuate at base, the lower sessile; stipules large: spikes dense, 1 or 2 inches long, on stout peduncles: fruit obliquely obovate, 1½ or nearly 2 lines long, carinate, acute: nutlet somewhat 3-keeled, the sides scarcely impressed: cotyledon incurved above the base of the embryo. — Amer. Journ. Sci. 2 ser. vi. 226 and vii. 350. *P. montanum*, Presl, Rel. Hænk. i. 85 and 351? *P. natans*, var. *fluitans*, Benth. Pl. Hartw. 341.

In streams or rarely in ponds; near Santa Cruz (*Hartweg*, n. 2017); Washington Territory (*Lyall*); Humboldt Pass, Nevada (*Watson*); and in the Atlantic States from British America to Mexico. Presl's description of the Monterey plant of Hænke leaves its identity very uncertain.

5. **P. amplifolius**, Tuckerman. Stems often stout, simple: floating leaves (sometimes wanting) 30–50-nerved, elliptic to oblong-lanceolate, acute, mostly rounded or slightly cordate at base, 2 to 4 inches long, on stout petioles about equalling the blade; stipules large and conspicuous; submerged leaves often very large (4 to 7 inches long by 2 inches wide or more), mostly falcate and somewhat undulate, acute, attenuate to a usually short petiole: spike thick and often dense, 1 to 3 inches long, on a very stout peduncle: fruit large (over 2 lines long), 3-keeled, with a broad stout beak: sides of the nutlet not pitted: embryo slender, the cotyledon incurved. — Amer. Journ. Sci. 2 ser. vi. 225 and vii. 349.

In ponds and streams; Sierra County (*Lemmon*); Oregon (*Hall*); common in the Atlantic States from New England to Kansas and New Mexico.

6. **P. gramineus**, Linn. Stems very slender, branching: floating leaves rather thin, 9–15-nerved, small (usually an inch or two long by 6 to 9 lines wide), oblong-elliptic, acutish, rounded or cuneate at base, on slender petioles mostly equalling or exceeding the blade; stipules broad, obtuse, an inch long or less; submerged leaves linear-lanceolate, variable in length, more commonly short (1 or 2 inches long by 1 to 3 lines broad, var. *heterophyllus*, Fries), acute or acuminate, narrowed at base: spikes about an inch long, rather loose, on stout often elongated peduncles: fruit round-obovate, a line long, acute, scarcely keeled: embryo stout; cotyledon incurved. — *P. heterophyllus*, Schreb.; Reichenb. l. c. 24, t. 41–43.

In still or flowing water; Soda Spring, near Mono Pass (*Brewer*); Ruby Lake, Nevada (*Watson*); Yellowstone Basin, Montana (*Richardson*); common eastward, from Canada to North Carolina, and also European.

* * *Leaves all submerged and uniform, thin and dilated (lanceolate to oval), numerous, mostly sessile: spikes dense, on stout peduncles.*

7. **P. lucens**, Linn. Stem stout, branching: leaves mostly thickish, usually large (2 to 6 inches long), oblong-lanceolate or oblanceolate, rather abruptly acute or acuminate, mucronate, often undulate-serrate, narrowed at base to a short petiole or subsessile; stipules large, often spreading: spikes 1 or 2 inches long; peduncles often elongated: fruit rounded, 1½ lines long, acute, slightly keeled: cotyledon in-

curved. — Reichenb. l. c. 22, t. 36, 37. *P. Proteus lucens*, Cham. in Linnæa, ii. 197, t. 5, fig. 16, a, b.

In ponds; at Mission Dolores (*Bolander*, n. 274) and also collected by *Chamisso* and *Kellogg & Harford;* rather rare eastward, from New England to Florida and New Mexico, and also European.

8. **P. prælongus**, Wulf. Stem stout, elongated, branching and flexuous above: leaves oblong-lanceolate or lanceolate, 2 to 10 inches long by 6 to 12 lines broad, obtuse and somewhat cucullate at the apex, rounded and clasping at base, undulate-serrate; stipules white and conspicuous, ½ to 1 inch long: peduncles often much elongated: fruit semicircular, 2 lines long, acutely keeled, prominently beaked: embryo slender, the cotyledon pointing to the base of the radicle. — Cham. l. c. 191, t. 5, fig. 14; Reichenb. l. c. 21, t. 33.

In ponds and deep water; Sierra County (*Lemmon*) and eastward, in New England and about the Great Lakes; also European. Fruit rare and maturing late.

9. **P. perfoliatus**, Linn. Stem more slender, not flexuous, branching: leaves broadly cordate to cordate-lanceolate, ½ to 1½ inches long, obtuse or acute, clasping at base; stipules small and not persistent: spikes rather loose and somewhat compound, short (3 to 9 lines long, or rarely more), on mostly short peduncles: fruit oblong-obovate, nearly 1½ lines long, obtusely keeled, beaked by the short slender style: embryo as in the last.

Var. (*l*) **lanceolatus**, Robbins. Leaves longer (2 to 4 inches or more), and more lanceolate, acuminate, undulate: peduncles thickened upward: fruit broader, nearly orbicular. — Gray, Manual, 488.

The variety only has been collected near the borders of California; Truckee River, Nevada (*W. W. Bailey*); Oregon and Washington Territory (*Lyall, Hall, Howell*); in the Yellowstone region (*Richardson*), and common in the northern Atlantic States, where the typical European form is also found.

* * * *Leaves all submerged and uniform, narrowly linear or setaceous, sessile.*

+ *Stipules free from the narrow base of the leaf.*

++ *Flowers in a linear cylindrical spike.*

10. **P. zosteræfolius**, Schum. Stem flattened and somewhat winged, branching: leaves grass-like, 3 to 8 inches long by 1½ lines wide, 3-nerved, abruptly acute, not narrowed toward the clasping base; stipules conspicuous, obtuse: spike rather loosely flowered, ½ to 1 inch long, shorter than the peduncle: fruit large (2 lines long), broadly oblong, beaked by the stout style, somewhat undulate-keeled: cotyledon incurved. — Cham. l. c. 182, t. 4, fig. 10; Reichenb. l. c. 17, t. 27. *P. compressus*, Fries, not Linn. herb. nor Oeder; Robbins in Gray's Manual, 488.

In still or slow-flowing water; found in Oregon (*Hall*, n. 491), and to be expected in Northern California; in British America and the northern Atlantic States, but not common, and in northern Europe.

++ ++ *Spike subcapitate, or (in* n. 13*) often loose or interrupted.*

11. **P. pauciflorus**, Pursh. Stem very slender, flattish, much branched, 8 to 20 inches high: leaves narrowly linear, 1- (obscurely 3-) nerved, an inch or two long by rarely half a line wide, acute, narrowed at base; stipules small, obtuse, becoming setose: spikes 2 – 10-seeded, on very short clavate flattened peduncles: fruit roundish, a line long, abruptly beaked by the rather slender straight style, and with a more or less broad undulate-dentate keel: embryo slender, with incurved cotyledon. — Cham. l. c. 176, t. 4, fig. 7.

In still waters; near San Francisco (*Chamisso, G. F. Vasey*); Oregon (*Hall, Howell*); common in the Atlantic States.

12. **P. Niagarensis**, Tuckerman. Stem often longer (1 to 3 feet): leaves larger, 1½ to 3½ (about 2) inches long by a line wide or less, 3 – 5-nerved at base,

very acute and mucronate, narrowed to the subpetiolate base: otherwise like the last, of which it is scarcely more than a variety. — Amer. Journ. Sci. 2 ser. vii. 351.

Walker's Basin (*Rothrock*, n. 292); in the Atlantic States, from the Great Lakes to South Carolina, but not common.

13. **P. pusillus**, Linn. Stem filiform, branching: leaves narrowly linear, 1 or 2 inches long, rarely a line wide, often nearly setaceous, 1–5-nerved, obtuse and mucronate or acute, biglandular at base and sessile; stipules obtuse, becoming setose: spikes capitate, or somewhat elongated and open, or interrupted, on slender flattened peduncles ½ to nearly 2 inches long: fruit as in the preceding, but more obscurely and obtusely keeled: embryo less incurved. — Reichenb. l. c., t. 22. *P. trichoides*, Benth. Pl. Hartw. 341.

In pools and ditches; near Santa Cruz (*Hartweg*, n. 2016) and at Soda Springs on the Upper Tuolumne (*Bolander*), the form with subsetaceous acute or cuspidate leaves, distinguished as var. *tenuissimus*, Mert. & Koch. The typical European form occurs in the northern Atlantic States and in British America.

+ + *Stipules united with the sheathing base of the leaf: spikes interrupted.*

14. **P. pectinatus**, Linn. Stem filiform, repeatedly branched: leaves very narrowly linear, 2 to 6 inches long, rarely over half a line broad, often setaceous, 1-nerved, acute: peduncles elongated, slender: spikes ½ to 2 inches long: fruit in often dense verticils, large (2 lines long), obliquely obovate, compressed, obtusely keeled, acute: nutlet very thick: embryo spirally incurved. — Reichenb. l. c. 11, t. 19.

Var. (*l*) **latifolius**, Robbins. Stem stouter: leaves short and broader (1 or 2 inches long by a line or two broad), 3–5-nerved with numerous transverse veinlets, acute or obtuse: sheaths large, with scarious margins, exceeding the obtuse scarious stipules. — Bot. King Exp. 338.

In various parts of California (*Chamisso, Coulter, Douglas*); Santa Barbara (*Mrs. Elwood Cooper*); Oregon and Washington Territory (*Lyall, Hall*); Northern Nevada and Utah (*Watson*), and common in the Atlantic States as well as in Europe. The variety has been collected in King's River and at Gulling's Hot Spring, Lassen County (*Lemmon*), and in the lower Humboldt River (*Watson*); it appears to scarcely differ from the European marine species *P. zosteraceus*, Fries, to which it might perhaps well be referred.

15. **P. marinus**, Linn. Resembling narrow-leaved forms of the last species, low and very leafy: peduncles much elongated: fruit much smaller (a line long) and thinner, round-obovate, not keeled upon the rounded back, tipped with the broad sessile stigma: embryo annular.

Var. (*l*) **occidentalis**, Robbins. Often taller and less leafy: peduncles usually rather short: spikes interrupted: nutlet slightly 3-keeled. — Bot. King Exp. 339.

The variety only has been collected in Truckee River and Ruby Lake, Northern Nevada (*Watson*), and is apparently a common species of the interior eastward to Montana (*Richardson*) and Colorado (*Hall & Harbour*), sometimes nearly approaching European forms.

16. **P. Robbinsii**, Oakes. Stem rather stout, often much branched and frequently flexuous: leaves numerous, distichous, the close sheaths nearly covering the stem, linear-lanceolate, 2 to 3 inches long by 2 lines broad, many-nerved, acuminate, ciliate-serrulate; stipules obtuse, becoming setose: spikes usually several, on rather stout pedicels about an inch long, loose and more or less interrupted, about half an inch long: fruit oblong-obovate, nearly 2 lines long, keeled with a broadish wing, acutely beaked: embryo stout, ovally annular. — Hov. Mag. vii. 178; Robbins, in Gray's Manual, 490.

In ponds and slow streams; not yet found in California, but to be expected; Oregon (*Hall*); Yellowstone region (*C. Richardson*); common in the northern Atlantic States.

Scanty specimens of what seems to be an undescribed species of this group have been collected in Pyramid Lake (*Miss S. A. Plummer*), without flowers or fruit. The stem is broad and flattened; the leaves thick, 6 inches long by 1½ lines broad, 3-nerved with transverse veinlets, conspicuously sheathing and with broad stipules.

8. TRIGLOCHIN, Linn. Arrow-grass.

Flowers perfect, in a naked slender raceme upon a scape-like peduncle, with an herbaceous deciduous perianth of 3 small concave sepals and as many similar petals. Stamens 3 or 6; anthers oval, nearly sessile. Ovary 3–6-celled, with sessile stigmas and solitary ovules, separating at maturity from the central axis into as many distinct pods. Seed anatropous, erect; testa membranous. Embryo straight, with minute included plumule. — Marsh perennial herbs, with fibrous roots, radical sheathing terete or semiterete fleshy leaves, and erect scapes.

A genus of about a dozen species, of which the two following are the more common and widely distributed.

1. **T. maritimum**, Linn. Rather stout, a span to 2 or 3 feet high: leaves shorter than the scape, a line or two broad, thickish: raceme usually crowded, 4 to 12 inches long: flowers a line broad: fruit oblong or ovate, obtuse at base, 6- (rarely 3–5-) carpelled, 1½ to 2½ lines long and about equalling the pedicels. — Reichenb. Icon. Fl. Germ. vii. 38, t. 52.

Near the sea-coast from about San Francisco to Alaska and the Arctic Ocean, and in saline places in the interior across the continent; also common in Europe and Asia.

T. PALUSTRE, Linn. Slender, ½ to 1½ feet high: leaves less than a line broad: flowers smaller, in a loose raceme: fruit narrow, attenuate at base, 3-carpelled, 2½ to 4 lines long, exceeding the pedicels, separating from below upward. — A common species of nearly the same range as the last, but not yet reported from California nor from localities nearer than Utah and Alaska.

9. SCHEUCHZERIA, Linn.

Flowers perfect, in a loose few-flowered bracteate raceme, with small herbaceous persistent perianth of 3 oblong sepals and 3 narrower petals. Stamens 6, with linear-oblong anthers on slender exserted filaments. Ovary of 3 nearly distinct ovoid 1–2-ovuled carpels, becoming divergent coriaceous subglobose pods, dehiscing ventrally: stigmas flat and sessile. Seeds ascending, anatropous, with coriaceous testa. Embryo straight, thick. — A marsh perennial herb, with a creeping jointed scariously sheathed rootstock, ascending flexuous simple stems, and sheathing channelled teretish leaves. A single species.

1. **S. palustris**, Linn. Stems a span high or less: leaves exceeding them, pitted at the tip: raceme 4–6-flowered, with sheathing bracts, the upper ones small: perianth about 1½ lines long: carpels 3 lines in diameter: seeds half as long. — Reichenb. Icon. Fl. Germ. x. t. 419.

Sierra County (*Lemmon*); Washington Territory (*Lyall*, *Suksdorf*), and eastward of the Rocky Mountains to New England and Canada; also in Europe and northern Asia. Said to have the odor of hydrochloric acid.

Order CXV. ALISMACEÆ.

Marsh herbs, with scape-like stems, sheathing leaves, and perfect or unisexual flowers; perianth of 3 herbaceous persistent sepals and as many often conspicuous white deciduous petals, which are imbricate or (in *Alisma*) involute in the bud; stamens 6 or more, included; ovaries numerous, distinct, 1-celled and mostly 1-ovuled, becoming akenes in fruit; seeds erect, campylotropous, with membranous testa; albumen none; embryo strongly recurved or uncinate. — Roots fibrous; leaves radical, petiolate, and strongly nerved with transverse veinlets, the earlier

sometimes without blade; flowers long-pedicellate, mostly verticillate, in a loose raceme or panicle, with lanceolate scarious bracts slightly connate at base.

An order of 4 genera and perhaps 50 species, sparingly distributed through the temperate and tropical regions of the globe.

* Flowers perfect: stamens usually 6: carpels verticillate.

1. **Alisma.** Carpels numerous, distinct, obovate-oblong, flattened.
2. **Damasonium.** Carpels 6 to 12, united at base, acuminate and radiately divergent.

* * Stamens rarely few: carpels capitate.

3. **Echinodorus.** Flowers perfect. Carpels several to many, turgid and ribbed, often beaked.
4. **Sagittaria.** Flowers monœcious or diœcious. Carpels numerous, flattened and membranously winged.

1. ALISMA, Linn. Water-Plantain.

Flowers perfect. Petals small. Stamens 6, rarely more, with short filaments. Ovaries distinct, numerous, on a disk-like receptacle, 1-ovuled; style very short, ventral. Akenes in a crowded whorl, obovate-oblong, flattened, obtuse, somewhat channelled on the back. — Perennial herbs, in shallow water or mud, with small flowers in a verticillately branched panicle.

About a dozen species, distributed through the northern temperate zone and tropical America; represented in the United States only by the following.

1. **A. Plantago,** Linn. Stout; scape a foot or two high, diffusely paniculate above: leaves ovate to oblong or lanceolate, often somewhat cordate at base, acute, usually 7-nerved, 2 to 8 inches long, when growing in water sometimes narrowly lanceolate or linear: petals scarcely exceeding the sepals, a line long or less, white or pinkish: carpels forming a circular or somewhat triangular whorl 2 or 3 lines in diameter. — Reichenb. Icon. Fl. Germ. vii. t. 57.

About San Francisco and throughout Northern California to British Columbia, and eastward across the continent; also throughout Europe and northern Asia, and in Australia. The most common species, and very variable as respects foliage, the forms being determined chiefly by the place of growth and not deserving to rank as varieties.

2. DAMASONIUM, Juss.

Flowers perfect. Stamens 6, with slender filaments. Ovaries 6 to 12, united by the short ventral side, flattened, ovate and attenuate upward, 1 – 2-ovuled; stigma terminal. Akenes long-acuminate, radiately and horizontally divergent. — Perennial herbs, with the habit of *Alisma*, but scapes simple.

Two or three other species occur in the Mediterranean region, and one in Australia.

1. **D. Californicum,** Torrey. Scapes usually more than one, from a somewhat enlarged base, 6 to 18 inches high: leaves with usually much elongated slender petioles, the blade ovate to narrowly lanceolate, 1 to 3 inches long, acutish or obtuse, 3 – 5-nerved: flowers in 3 or 4 whorls, on pedicels an inch or two long: petals 3 or 4 lines long, rounded, incised at the summit, exceeding the oblong obtuse sepals: carpels usually 8 or 9, abruptly narrowed to a long rigid beak, much compressed, 4 or 5 lines long, 1-seeded. — Pacif. R. Rep. iv. 142, t. 21; Benth. Pl. Hartw. 311. *Alisma Californica,* Bolander, Cat. 29.

Valleys in the Sierra Nevada; Ione Valley, Amador County, in water (*Bigelow*); Sierra Valley (*Lemmon*); also found by *Hartweg.*

3. ECHINODORUS, Richard.

Flowers perfect. Petals small. Stamens 6 to many, with short slender filaments. Ovaries usually numerous, crowded in a globose head, distinct, more or less attenuate

into the terminal style. Akenes obpyramidal, sharply ribbed. — Mostly annuals, with the habit of *Sagittaria*, the naked stems sparingly branched or simple, and the flowers on rather short pedicels, in whorls of 3 to 6 or more.

A genus of 8 or 10 species, belonging to tropical America and the Atlantic States. Only one species approaches the borders of California.

1. **E. rostratus,** Engelm. Annual, with one or more stems from the same root, erect, usually a foot or two high : leaves broadly ovate, cordate or truncate at base, obtuse or acutish, rarely lanceolate with a cuneate base, 1 to 4 inches long, on rather stout petioles : pedicels half an inch long : petals scarcely exceeding the sepals, 1 to $1\frac{1}{2}$ lines long : stamens 12 : akenes very numerous, a line long, with a beak nearly half as long, 4 – 5-ribbed and with intermediate veins. — Gray, Manual, 492.

On Mohave Creek (*Bigelow*), and frequent eastward from Texas to Illinois and Florida.

4. SAGITTARIA, Linn. Arrow-head.

Flowers monœcious (or sometimes diœcious), the staminate ones above. Petals usually conspicuous. Stamens numerous, rarely few. Ovaries very many, crowded in globose heads, distinct. Akenes flat and membranously winged, abruptly beaked by the very short style. — Stoloniferous perennials, with milky juice, broadly sheathing leaves often without a blade, and mostly simple stems bearing one to few whorls of flowers usually in threes.

A genus of both the Old and New World, including about 20 species, of which half are found in the Atlantic States and Texas. But one has been detected on the Western Coast.

1. **S. variabilis,** Engelm. l. c. Rootstock slender, tuberiferous : scape $\frac{1}{2}$ to 2 feet high or more, angled : leaves very variable, ovate-sagittate or more or less narrowed or even linear, acute, the similar lobes more or less divergent, acuminate ; the larger leaves often 6 inches long or more : petals white, rounded, 4 to 6 lines long, exceeding the sepals : filaments usually as long as or longer than the anthers, attenuate upward : fruiting heads nearly half an inch in diameter : akenes rather broadly obovate, $1\frac{1}{2}$ lines long, with a conspicuous acute horizontal beak at the upper angle.

In Pitt River, among tules (*Brewer*) ; Plumas County (*Mrs. Ames, Mrs. Austin*) and in Northern Nevada, and northward to British Columbia ; common east of the Rocky Mountains to the Atlantic in numerous forms. The large tubers (an inch or more in diameter) are used for food by the Indians. *S. Chinensis,* Sims, a very similar species, is cultivated by the Chinese for the same purpose, and is reported as introduced by them into California and to have been occasionally found growing in marshes near their settlements.

Order CXVI. JUNCACEÆ.

Flowers perfect, with a regular persistent perianth of 6 similar glumaceous segments in 2 rows, 6 nearly hypogynous included stamens (rarely 3) with persistent filiform filaments and 2-celled anthers, and a superior 3-celled ovary (sometimes 1-celled with 3 parietal placentæ) with 3 or many ascending anatropous ovules, a single very short style, and 3 filiform stigmas (flowers very rarely dimerous throughout) ; capsule loculicidally 3-valved ; seeds with membranous or cellular testa, often caudate or appendaged ; embryo minute, thick, enclosed within the base of the fleshy albumen. — Rushes or sedge-like herbs, mostly cespitose perennials or with creeping rhizomes, with terete hollow or spongy usually simple stems, and alternate sheathing leaves, either flat, channelled, or terete ; flowers small, usually sessile, scarious-bracteolate, in cymes or panicles, subumbellate clusters or spicate heads.

A heterogeneous order of a dozen genera or more, of which most are peculiar to Australia, the two following typical genera the most important, and chiefly confined to temperate and arctic regions.

1. **Luzula.** Capsule 1-celled, with 3 parietal 1-seeded placentæ. Leaves flat and soft, often villous. Stems hollow, leafy. In dry ground.
2. **Juncus.** Capsule mostly 3-celled, many-seeded. Leaves terete or flat, not villous. Stems usually with spongy pith. In moist ground or water.

1. LUZULA, DC. Wood-Rush.

Stamens always 6. Capsule triangular-ovate, 1-celled, with 3 erect seeds or often 1-seeded. — Perennial and grass-like, with hollow leafy slender and simple stems and flat or somewhat carinate lax leaves, often villous; flowers solitary in loose involucrate umbels or panicles, or more or less densely clustered or spicate; floral bracts small and scarious. Growing in dry woods or open grounds.

A widely distributed genus of about 30 species, with rather obscure characters. A half-dozen species are found in North America, most of them belonging also to the Old World.

* *Pedicels* 1*-flowered, in a loose compound cyme.*

1. **L. spadicea,** DC. Glabrous or slightly villous: stems 6 to 18 inches high or more: leaves broad (2 to 5 lines): inflorescence lax and nodding, much exceeding the usually small involucral bracts: perianth straw-color or more or less tinged with brown; segments lanceolate, acuminate, about a line long, slightly shorter than the acute apiculate capsule: anthers much exceeding the filaments: seed oblong, brownish, not appendaged. — Meyer, Linnæa, xxii. 399; Reichenb. Icon. Fl. Germ. ix. t. 387.

Var. **parviflora,** Meyer. Inflorescence often 3 to 6 inches long, with elongated unequal drooping branches and slender pedicels: flowers usually smaller: anthers about equalling the filaments. — *L. parviflora,* Desv.; Kunth, Enum. iii. 300; Reichenb. l. c., t. 388.

Var. **melanocarpa,** Meyer. Capsule dark brown; otherwise as the preceding. — *L. melanocarpa,* Desv.; Kunth, l. c. 299. *L. parviflora,* var. *melanocarpa,* Gray, Manual, 536.

Var. **subcongesta.** Like the preceding varieties, but the pedicels short and more or less fascicled at the ends of the branches of the cyme.

A very variable species, of Europe, Siberia, and the northern part of America, ranging from the Arctic Ocean southward in the mountains to California, Colorado and the northern Atlantic States; chiefly the varieties. Humboldt County, along water-courses (*Rattan*), the var. *parviflora;* in the Sierra Nevada, near Donner Lake (*Torrey, Greene*), the var. *subcongesta,* which has also been collected on Mt. Ranier (*Tolmie*), in the Clover Mountains, Nevada (*Watson,* n. 1191 in part), and in the Rocky Mountains, *Hall & Harbour,* n. 555.

2. **L. divaricata,** Watson. Resembling var. *parviflora* of the last species, but the cyme diffuse with divaricately spreading branches and pedicels: stem low (6 to 8 inches or less): perianth tinged with brown: seeds pale, with the basal end darker. — Proc. Am. Acad. xiv. 302.

In the Sierra Nevada, apparently frequent; above Mono Lake at 10,500 feet altitude and at the Big Trees (*Brewer*); above Summit Station (*Greene*); near Castle Peak, *Lemmon.*

* * *Flowers spicate: spikes erect, mostly pedunculate in a cymose umbel.*

3. **L. comosa,** Meyer. Villous: stems 6 to 15 inches high, leafy: leaves flat, 1 to 3 lines broad; the foliaceous bract usually exceeding the inflorescence: peduncles 2 to 12, unequal, the longer 1 to 3 inches long: spikes simple, usually oblong, loosely flowered: perianth pale or somewhat tinged with brown, about 1½ lines long; segments narrowly acuminate, equalling the obtuse capsule: anthers small, equalling the filaments: seed dark, with a white conical appendage sometimes half as long as the seed. — Syn. Luz. 23, Rel. Hænk. i. 145, and Linnæa, xxii. 413.

Var. **macrantha.** Perianth 2 or 3 lines long, much exceeding the broad obtuse capsule: anthers linear, equalling or twice longer than the filament: seed larger, the appendage always short.

Var. **subsessilis.** Spikes solitary or few, nearly sessile, loose: perianth-segments lax and scarious: otherwise as the last variety.

Var. **congesta.** Spikes several, sessile and close, forming a somewhat pyramidal head: perianth brown, 1½ lines long. — *L. campestris*, var. *congesta*, Meyer, as to American localities.

In the Coast Ranges and in the Sierra Nevada from Monte Diablo and the Yosemite northward to Oregon and Alaska; also in the Rocky Mountains. Very variable; the last variety near the coast.

4. **L. campestris,** DC. Very similar to the typical form of the last species, but usually less villous; bracts short; spikes dense, short and ovate; perianth-segments 1 to 1½ lines long, often dark brown. — Meyer, l. c. 407; Reichenb. l. c., t. 375.

A very widely distributed species and very common in the Atlantic States, but apparently rare westward. It occurs in Oregon (*Hall*) and Alaska, and has been collected in Plumas County by *Mrs. R. M. Austin.*

L. SPICATA, Desv. (Reichenb. l. c., t. 379), with carinate and folded leaves, usually a solitary and compound dense nodding spike, short perianth and usually dark brown acute capsule a line long, and seeds not appendaged, is an alpine and arctic species which may also be found in the high Sierra Nevada; Washington Territory (*Lyall*), E. Humboldt Mountains (*Watson*), and eastward.

2. JUNCUS, Linn. Boc-Rush.

Stamens 6, or sometimes 3 by suppression of the inner ones. Capsule globose to pyramidal, many-seeded, 3-valved, 3-celled with central placentæ or 1-celled with parietal placentæ. — Perennial or sometimes annual, in water or moist places, glabrous, with simple terete often pithy stems, leafy or leafless; leaves terete, channelled, or flat, sometimes equitant, in some species knotted; flowers solitary or clustered, in cymes, panicles, or heads. — Engelm. in Trans. St. Louis Acad. ii. 424.

A genus of about 130 species, many of them widely distributed and a few almost cosmopolitan. Over 50 species are North American. They are frequently abundant, forming bogs in marshy places, but are of little use and furnish poor and innutritious fodder.

* Perennials, with naked terete stems: leaves terete or none: panicle lateral, sessile.

Flowers clustered: inner sheaths leaf-bearing: stem and leaves stout and pungent.

Inner perianth-segments obovate, emarginate, a line long: capsule subglobose, obtuse. — 1. J. ROBUSTUS.

Segments lanceolate, acute, 3 lines long: capsule ovate, obtuse. — 2. J. COOPERI.

Flowers solitary: sheaths leafless (except in n. 5 and n. 10): less rigid and mostly more slender.

Flowers large, in compound panicles: capsule oblong-ovate.

Often stout: panicle lax and spreading: flowers 3 lines long: capsule acute, not beaked. — 3. J. LESUEURII.

Flowers smaller: capsule angled, mucronate or beaked. — 4. J. BALTICUS.

Low and very slender: panicle loose, few-flowered: sheaths frequently leaf-bearing. — 5. J. COMPRESSUS.

Stem stouter, somewhat flattened: panicle small and dense. — 6. J. BREWERI.

Flowers smaller, in compound panicles: capsule obovate or subglobose.

Perianth a line long: stamens 3: capsule clavate-obovate, obtuse or retuse. — 7. J. EFFUSUS.

Perianth longer, more spreading: stamens 6: capsule subglobose, obtuse, apiculate. — 8. J. PATENS.

Flowers few (1 to 3): low and alpine: capsule oblong.

Inner sheaths bristle-tipped: capsule retuse. — 9. J. DRUMMONDII.

Inner sheaths leaf-bearing: capsule acute. — 10. J. PARRYI.

* * Panicle or head terminal on the naked or leafy stem: leaves flat, channelled, or semiterete, not knotted.

Low annuals, with fibrous roots: stems leafy, branched.
- Stamens 6: capsule oblong: branching from the base: flowers remote. 11. J. BUFONIUS.
- Stamens 3: capsule ovate, apiculate.
  - Stem very short with several scape-like peduncles: flowers in a small head. 12. J. TRIFORMIS.
  - Stem very short and very much branched: peduncles 1–2-flowered. 13. J. KELLOGGII.

Taller perennials: stems simple: stamens 6.
- Stems naked: flowers solitary in a diffuse (rarely compact) cyme. 14. J. TENUIS.
- Stems leafy: leaves flat and grass-like (not equitant): flowers capitate or clustered.
  - Stem low, mostly equalling the leaves: ligules none: heads solitary or few.
    - Spathes short: perianth equalling the capsule. 15. J. FALCATUS.
    - Spathes elongated: perianth shorter than the capsule. 17. J. OBTUSATUS.
  - Stem taller, exceeding the leaves: ligules present: heads 5 to 9. 16. J. LONGISTYLIS.

* * * Stems leafy: leaves terete or laterally flattened, knotted transversely: inflorescence terminal: flowers capitate.

Leaves terete or subcompressed.
- Stamens 3; anthers shorter than the filaments: heads few.
  - Dwarf: early leaves capillary and floating: heads few-flowered. 18. J. SUPINIFORMIS.
  - Tall: ligules conspicuous: heads many-flowered. 19. J. BOLANDERI.
- Stamens 6.
  - Stout: capsule narrow, acuminate.
    - Leaves divergent: heads few, very many-flowered: anthers shorter than the filaments. 20. J. NODOSUS.
    - Heads numerous in a compound panicle: anthers longer than the filaments. 21. J. DUBIUS.
  - Slender: capsule oblong, abruptly acute.
    - Leaves very narrow: heads small, one to many: anthers longer than the filaments. 22. J. NEVADENSIS.

Leaves flattened and equitant.
- Stems stout, ancipital: leaves broader.
  - Heads small, numerous in a compound panicle: perianth-segments linear-lanceolate: anthers exceeding the filaments: capsule narrow, attenuate, exserted: ligules present. 23. J. OXYMERIS.
  - Heads usually many and larger: segments lanceolate: anthers short: capsule oblong, acute: ligules none. 24. J. XIPHIOIDES.
  - As the last; anthers much longer: stigmas long-exserted. 25. J. PHÆOCEPHALUS.
- Stems low, slender, compressed: leaves very narrow, with ligules.
  - Heads 1 or 2: perianth-segments pale and scarious, often obtuse. 26. J. CHLOROCEPHALUS.
  - Head solitary, many-flowered: segments very dark, narrowly acuminate. 27. J. MERTENSIANUS.

* *Stems leafless and scape-like, from matted rootstocks, sheathed at base; the sheaths sometimes bearing terete leaves like the scape: flowers in sessile apparently lateral panicles.* — JUNCUS proper.

+– *Flowers clustered, hexandrous: scapes stout, the inner sheaths leaf-bearing: spathes usually shorter than the inflorescence.*

1. **J. robustus**, Watson. Scape and leaves 2 to 4 feet high or more, stout, rigid and pungent: panicle compound with very unequal branches, usually 3 to 6 inches long, erect and strict, about equalling or exceeding the spathe: secondary spathes and bracts long-acuminate, equalling or exceeding the flowers: clusters 2–4-flowered: perianth-segments scariously margined, the outer broadly lanceolate, acute, the inner obovate and deeply emarginate, a line long, exceeding the stamens: style nearly equalling the stigmas: capsule subglobose, narrower at base, rounded at the summit, apiculate, brown, nearly 2 lines long: seeds acute at each end or slightly caudate, about ½ line long, very finely ribbed. — Proc. Amer. Acad. xiv. 302. *J. acutus*, Engelm. l. c. 438. *J. acutus*, var. *sphærocarpus*, Engelm. in Wheeler's Rep. vi. 376.

Southern California; frequent in marshes in the Coast Ranges, from Santa Clara Valley (*Peckham*) to San Diego, *Cooper*. Resembling *J. acutus* of the Old World, which has a shorter and more spreading panicle, shorter spathes and bracts, a triangular and acute capsule, and usually more distinctly caudate seeds. The tough scapes are split by the Indians and used in binding together their baskets.

2. **J. Cooperi**, Engelm. A similar species: outer perianth-segments subulate-lanceolate, acute, the inner ovate-lanceolate and mucronate, 3 lines long: anthers $1\frac{3}{4}$ lines long: capsule ovate, acute, slightly longer than the perianth, greenish: seeds larger, with broad white appendages, more irregularly ribbed. — Trans. St. Louis Acad. ii. 586.

Known only from a single imperfect specimen, collected at Camp Cady on the Mohave River (*J. G. Cooper*): scape nearly 2 feet high, with a greenish panicle 3 inches long.

+– +– *Flowers solitary, hexandrous (triandrous in* n. 7): *scapes slender: sheaths leafless except in* Nos. 5 *and* 10: *spathes usually very much exceeding the inflorescence.*

++ *Flowers in compound panicles, large (2 lines long or more): capsule oblong-ovate.*

3. **J. Leseurii**, Boland. Scapes often stout, but soft and sometimes hollow, 1 to 3 feet high, from a stout creeping rhizome: panicle lax and spreading, many-flowered, the flowers somewhat secund on the branches: perianth-segments $2\frac{1}{2}$ to 3 lines long, lanceolate, acuminate, with brown margins, the inner ones a little shorter and obtusish: anthers much longer than the filaments: capsule brown, oblong-ovate, acute, not beaked, equalling or a little shorter than the perianth: seeds ovate, obtuse, scarcely apiculate, smoothish or somewhat reticulate. — Proc. Calif. Acad. ii. 179; Engelm. l. c. 490. *J. Balticus*, Benth. Pl. Hartw. 341. *J. pictus*, Philippi, in Linnæa, xxxiii. 368. *J. Balticus*, var. *Pacificus*, Engelm. l. c. 442.

Var. **elatus**. Rigid, stout and tall (6 feet high or more): panicle lax and widely spreading (3 to 6 inches).

In salt marshes and saline localities near the coast; Sacramento Valley (*Hartweg*); about San Francisco, *Bolander*. The variety at higher elevations, in San Gabriel cañon (*Brewer*) and near Los Angeles, *Wood*. The species is also Chilian, according to Engelmann. What appears to be the same, but with the panicle small and compact, was collected in flower at Klatsop, Oregon, on the sea-shore in drifting sand, by *Prof. Wood*.

4. **J. Balticus**, Dethard. Distinguished from the last by its rather more rigid scapes (usually 1 or 2 feet high), smaller flowers ($1\frac{1}{2}$ to $2\frac{1}{2}$ lines long), the capsule more acutely angled (in our forms) and mucronate or beaked, and the seeds more distinctly reticulated. — Reichenb. Icon. Fl. Germ. ix. t. 411; Engelm. l. c. 441 and 490.

A species of northern Europe, ranging through North America from Alaska to Southern California and across the continent; varying considerably in the comparative length of the perianth-segments, in the size of the capsule, and to some extent also in the characters of the seeds. In the Yosemite Valley (*Bolander*), Talley's Ranch, San Diego County (*Palmer*), and above Carson City (*Anderson*), the ordinary form; on the borders of Mono Lake (*Bolander*) and Soda Lake, Northern Nevada (*Watson*), a form with the light-brown capsule exceeding the perianth.

5. **J. compressus**, HBK. Resembling very slender forms of *J. Balticus*, but the scapes (6 to 12 inches high) somewhat flattened, and the sheaths frequently leaf-bearing: spathe equalling or much exceeding the small loosely few-flowered panicle: capsule shorter than the paler perianth. — Nov. Gen. i. 235; Kunth, Enum. iii. 317; Engelm. l. c. 440.

A Mexican species, ranging to New Mexico (*Fendler*), Arizona (*Palmer*) and Southern California; Salinas Valley (*Brewer*); Fort Tejon (*Rothrock*); Santa Clara and Buena Ventura valleys, *Peckham*.

6. **J. Breweri**, Engelm. l. c. Scape stouter, a foot high, from a perpendicular rhizome, somewhat flattened and often twisted: spathe many times longer than the small and dense usually few-flowered panicle: perianth-segments brown, oblong-

ovate, acuminate, the inner acute, 2 lines long: anthers much exceeding the filaments: capsule and seeds unknown.

Near Monterey (*Brewer*); Santa Cruz, *Wood.*

++ ++ *Flowers in compound panicles, smaller: capsule obovate or subglobose.*

7. **J. effusus,** Linn. Scapes soft, usually 2 to 4 feet high: inner sheaths tipped with a short awn: panicle slender and usually diffuse, many-flowered: perianth pale, a line long, the segments lanceolate, acuminate, equalling the triangular clavate-obovate obtuse or retuse capsule: stamens 3, the anthers equalling the filaments: seeds apiculate, finely ribbed, about ¼ line long. — *J. communis,* Meyer; Kunth, Enum. iii. 320.

Var. **brunneus,** Engelm. l. c. 491. Panicle usually very short and compact: perianth and capsule dark brown. — *J. procerus* (?), Engelm. l. c. 442.

The typical form is distributed throughout most of the northern temperate regions of both the Old and New Worlds, and is also found in Australia and New Zealand. It is very common in the Atlantic States, and is found in Oregon, in the Sierra Nevada (Mariposa County, *Bolander* and others), about San Francisco, and in the Cuyamaca Mountains, *Palmer.* The variety is a coast form, common in the salt-marshes about San Francisco Bay, collected also at Santa Barbara (*Wood*), and in Oregon.

8. **J. patens,** Meyer. Resembling the ordinary form of the last: flowers somewhat larger (1½ lines long), the pale or brownish perianth more spreading in fruit: stamens 6: capsule subglobose, slightly angled, obtuse, apiculate, equalling or a little shorter than the perianth, with thin septa, the valves breaking from the central placentæ. — Rel. Hænk. i. 141; Engelm. l. c. 443.

From Santa Barbara County (Santa Inez Mountains, *Mrs. Elwood Cooper;* Santa Lucia Mountains, *Brewer*) to Oregon, *Hall.* The panicle is usually spreading, an inch or two long, sometimes more compact; flowers somewhat secund on the branches.

++ ++ ++ *Flowers few* (1 *to* 3): *low and alpine.*

9. **J. Drummondii,** Meyer. Cespitose: scapes very slender, a foot high or less: inner sheaths bristle-tipped: spathe usually a half to an inch long, equalling or exceeding the inflorescence: perianth-segments 3 lines long or more, with brown margins, lanceolate, acute or acuminate, the inner a little shorter: anthers a little longer than the filaments: capsule brown, oblong, retuse, nearly equalling the perianth: seeds ovate, caudate, a line long, very finely striate. — Ledeb. Fl. Ross. iv. 235; Engelm. l. c. 445.

In the Sierra Nevada, at an altitude of 8,000 to 10,000 feet, and northward to Alaska; also in the Rocky Mountains.

10. **J. Parryi,** Engelm. l. c. 446. Cespitose: scapes filiform, 3 to 6 inches high: inner sheaths leaf-bearing; the leaves sulcate at base, terete above, much shorter than the scape: spathe exceeding the inflorescence, ½ to 1½ inches long: perianth-segments 3 lines long or more, more or less tinged with brown, lanceolate and acuminate or the inner obtuse: anthers much longer than the filaments: capsule oblong, acute, about equalling the perianth: seeds as in the last.

In the Sierra Nevada, in alpine meadows (*Bolander*), and northward to British Columbia; in the East Humboldt Mountains (*Watson*) and Rocky Mountains of Colorado.

* * *Leaves flat, channelled, or semi-terete, not knotted: panicle or head evidently terminal upon the naked or leafy stem, the spathe usually short.*

+– *Dwarf or low slender annuals, with fibrous roots: stem leafy, branched.*

11. **J. bufonius,** Linn. Stem usually branching from the base, 1 to 12 inches high: leaves very narrow, usually revolute and bristleform: flowers greenish, mostly remote and secund upon the spreading branches: perianth-segments lanceolate, acuminate, with scarious margins, 2 or 3 lines long, the inner shorter: stamens 6; anthers about equalling the filaments: capsule oblong, obtuse, shorter than the peri-

anth: seeds ovate, obtuse, very finely striate and cross-lined. — Reichenb. Icon. Fl. Germ. ix, t. 395; Engelm. l. c. 451.

A common species, found in nearly all countries, very variable in size; from Oregon to Lower California, on both sides of the Sierra Nevada.

12. **J. triformis**, Engelm. l. c. 492. Stem almost none, bearing several erect filiform scape-like peduncles 2 to 4 inches high: leaves an inch long or less, filiform, channelled, flat above: flowers usually 3 to 7 in a small head: perianth brownish, 1 to 1½ lines long; segments narrowly lanceolate, acuminate, nearly equal, a little exceeding the 3 stamens and the ovate obtuse apiculate capsule: style exserted, with elongated stigmas: seeds ovate, obtuse, faintly few-ribbed and cross-lined.

Var. **brachystylus**, Engelm. l. c. Smaller (1 or 2 inches high), the peduncles 1–3-flowered: stamens half the length of the perianth, the oblong anthers shorter than the filament: style and stigmas short, included.

Var. **uniflorus**, Engelm. l. c. Very small (a half to an inch high), the solitary flowers mostly dimerous. — *J. saginoides*, Engelm. l. c. 436.

In the mountains from Yosemite Valley and Mendocino County to Oregon; Clover Mountains, Nevada, at 9,000 feet altitude, *Watson*.

13. **J. Kelloggii**, Engelm. l. c. 494. Stem very short and very much branched, forming a small dense sessile globose cluster ¼ to ½ inch broad, with a few exserted 1–2-flowered peduncles: leaves 6 to 10 lines long, filiform, channelled above: perianth-segments pale green, mostly scarious, 1½ lines long, lanceolate, acuminate, exceeding the stamens and thin capsule: seeds more strongly ribbed.

Sandy soil, San Francisco (*Kellogg*); April, in flower and fruit.

+– +– *Taller perennials: stems simple: flowers hexandrous.*

++ *Stems naked: flowers solitary in a diffuse (rarely compact) panicle.*

14. **J. tenuis**, Willd. Stems slender, erect, 1 or 2 feet high, leafy at base: leaves very narrow, flat or more or less channelled or involute, shorter than the stem: spathe exceeding the inflorescence: panicle usually loose and spreading: perianth-segments pale, narrowly lanceolate, acuminate, 1½ to 2 lines long, spreading in fruit and equalling or usually exceeding the ovate retuse greenish capsule: seeds white-appendaged at each end, very finely ribbed and cross-lined. — Reichenb. l. c., t. 398.

Var. **congestus**, Engelm. l. c. 450. Panicle contracted and somewhat capitate, 3 to 9 lines broad: perianth and capsule darker.

A very common species in the Atlantic States, ranging across the continent and to Mexico and the West Indies, and also found in western Europe. On the Pacific Coast it is found from Oregon to Southern California (Santa Inez Mountains, *Mrs. Elwood Cooper*), though the variety, which is peculiar, is perhaps the more common form, at least near the coast.

++ ++ *Stems more or less leafy; the leaves flat and grass-like (not equitant): flowers clustered.*

15. **J. falcatus**, Meyer. Stems low, rarely a foot high, from slender stoloniferous rootstocks: leaves usually equalling or exceeding the stems, 1 to 1½ lines wide, the open somewhat oblique sheaths without ligules: heads mostly solitary, sometimes 2 or 3: spathe short: perianth-segments dark brown or with a green midvein, 2½ to 3 lines long, ovate, the outer shortly acuminate, the inner obtuse, roughish: capsule oblong, retuse, apiculate, equalling the perianth: seeds oblong-ovate, obtuse, a third of a line long, with loose pale testa longitudinally reticulate. — Engelm. l. c. 452 and 495. *J. Menziesii*, R. Br. in Hook. Fl. Bor.-Am. ii. 192.

Var. **paniculatus**, Engelm. l. c. 495. Heads smaller (about 5-flowered), in a simple or somewhat compound panicle.

In drift sand on Lone Mountain, near San Francisco, and northward in the Coast Ranges to Oregon and Unalaschka; the variety in sphagnous swamps near Mendocino City, *Bolander*. In Central Oregon a taller slender form occurs, 1 or 2 feet high, with a loose panicle 3 to 5 inches long, *Wood*.

16. **J. longistylis**, Torrey. Taller (a foot or two high); leaves much shorter than the stems, the sheaths with distinct ligules: heads usually 5 to 9, in a short sparingly branched panicle, exceeding the very short spathe, sometimes fewer or solitary, few-flowered: perianth paler, the segments rather narrower and usually more acuminate: seeds oblanceolate, brownish, much smaller, faintly ribbed.— Bot. Mex. Bound. 223; Engelm. l. c. 453.

Var. (?) **latifolius**, Engelm. l. c. 496. Leaves short, broader (2 to 2½ lines broad), the sheaths without ligules: anthers more elongated.

On the eastern side of the Sierra Nevada from Washington Territory to Arizona, New Mexico, and the Saskatchewan; Mono Lake (*Bolander*); Truckee Valley, *Bailey*. The variety belongs to the Sierra Nevada; in the Yosemite Valley, at 4,000 feet altitude, and on the Upper Tuolumne at 10,000 feet (*Bolander*), and frequent on the eastern slope, *Anderson*.

17. **J. obtusatus**, Engelm. l. c. 495. Stems 6 inches high, from a creeping rootstock, about equalling the narrow (a line broad) leaves: sheaths without ligules: spathes much exceeding the inflorescence: heads few in a simple panicle or solitary, few-flowered: perianth-segments shorter (1½ lines), greenish, the outer ovate and acutish, the inner very obtuse, shorter than the oblong-ovate obtuse very shortly apiculate capsule: seeds brownish, very small, ovate, obtuse, minutely reticulate.

Near the Big Tree Grove, Mariposa County, in large tufts on the sandy banks of streamlets, *Bolander*.

* * * *Stems leafy: leaves terete or laterally flattened, more or less distinctly knotted by internal transverse partitions: flowers capitate: perennial.*

+– *Leaves terete or only slightly compressed.*

++ *Stamens* 3.

18. **J. supiniformis**, Engelm. l. c. 461. Early leaves elongated and capillary, floating, pale green: stems low (2 to 4 inches), shorter than the erect subterete cauline leaves: panicle simple, of 3 to 6 small heads, which are about 5-flowered: perianth-segments brownish, narrowly lanceolate, acute, nerved, 1½ or 2 lines long, shorter than the oblong acutish stoutly beaked capsule: anthers oblong, shorter than the filament: seeds obovate, rather large, apiculate at each end.

In ponds near Mendocino City (*Bolander*); Humboldt County, *Kellogg* & *Harford*, n. 1041, 1042.

19. **J. Bolanderi**, Engelm. l. c. 470. Stems slender, 2 feet high or more, about equalling the subterete leaves: ligules of the sheaths conspicuous, sometimes elongated and leaf-like: heads subglobose, usually 2 or 3, very many-flowered: perianth-segments greenish brown, narrowly lanceolate and setaceously acuminate, 1½ lines long, exceeding the clavate-oblong obtuse apiculate 1-celled capsule: filaments several times longer than the oblong-linear anthers: seeds very small, obovate.

Found in swamps near Mendocino City (*Bolander*) and in Humboldt County *Kellogg* & *Harford*, n. 1052.

++ *Stamens* 6.

20. **J. nodosus**, Linn. Stems slender, from a very slender creeping tuberiferous rootstock: leaves somewhat compressed, erect: heads few, 8–20-flowered, subglobose: perianth-segments brownish, 1½ to 2 lines long, lanceolate, acuminate, nearly equalling the narrow acuminate capsule: anthers oblong, shorter than the filament: seeds ovate, rather abruptly apiculate at each end, reticulate, brownish. — Var. **megacephalus**, Torr. Stems stout, 1 to 3 feet high: leaves thick, divergent: heads larger and very many-flowered, on short stout peduncles or sessile; panicle sometimes compound: perianth paler, about 2½ lines long, the segments very narrow and setaceously acuminate.

The typical form has not been collected in California or Oregon, though common eastward: the variety was collected in California by *Coulter*, and is frequent in Oregon and the interior (Nevada, *Watson*; Arizona, *Palmer*), ranging to the Atlantic States.

21. **J. dubius,** Engelm. l. c. 459. Stems rather stout, 2 to 4 feet high, from stout horizontal rootstocks: leaves somewhat compressed: panicle compound, diffuse, 3 to 12 inches long; heads 6–20-flowered, numerous: perianth brown or brownish, 1½ lines long; the segments lanceolate, acuminate: anthers elongated, exceeding the filament: capsule and seeds as in the last.

Big Tree Grove, Mariposa County (*Bolander*); Walker's Basin, Kern County (*Rothrock*, n. 287); Cuyamaca Mountains (*Palmer*, n. 384, distributed as *J. nodosus*); and apparently also from Oregon (*Hall*, n. 547, 548, distributed as *J. acuminatus*; *Howell*), but the seed-testa somewhat paler and thicker.

22. **J. Nevadensis,** Watson. Stem very slender, from a slender creeping rootstock, ½ to 2 feet high, somewhat compressed, as also the very narrow (rarely a line broad) leaves: ligules present: heads small, few to rather many in a short open panicle, or frequently solitary: perianth-segments brownish, lanceolate, acuminate, 2 lines long: anthers linear, exceeding the filament: stigmas long-exserted: capsule oblong, abruptly acute and beaked, nearly equalling the perianth: seeds minute, narrow, apiculate at each end. — Proc. Amer. Acad. xiv. 303. *J. phæocephalus*, var. *gracilis*, Engelm. l. c. 473.

Frequent in the Sierra Nevada, from Kern County (*Rothrock*) to Oregon.

++ *Leaves flattened laterally and equitant, mostly broader: stem compressed and usually acutely edged.*

23. **J. oxymeris,** Engelm. l. c. 483. Differing from *J. dubius* only in the ancipital stems, the broader and flattened leaves (1½ to 3 lines broad), and in the seeds, which are lighter colored and more finely reticulated: capsule usually more attenuate above, exceeding the linear-lanceolate perianth-segments: anthers twice longer than the filament.

From Mariposa County and the Sacramento Valley to Oregon. Distinguished from the following species by the numerous small heads, narrower segments, and narrow attenuate capsule.

24. **J. xiphioides,** Meyer. Stems from a thick creeping rootstock, ancipital, 2 to 4 feet high: leaves usually broad (2 or even 3 lines wide or more), the sheaths without ligules: heads numerous, few–many- (3–20-) flowered, in a compound panicle: perianth-segments brownish, 1½ lines long, lanceolate, acuminate, about equalling the oblong acute capsule, twice longer than the 6 stamens: anthers very small, oblong-linear, equalling or much shorter than the filaments: seeds very small, ovate-oblanceolate, reticulate and finely cross-lined within the veining. — Engelm. l. c. 481.

Var. **auratus,** Engelm. l. c. Heads few-flowered, pale straw-color: capsule exceeding the perianth, with a longer slender beak.

Var. **montanus,** Engelm. l. c. Lower (usually 1½ feet high or less) and leaves narrower (a line or two wide): heads few (1 to 9), usually many- (12–50-) flowered: perianth usually equalling the acute capsule.

Var. **triandrus,** Engelm. l. c. 482. A foot or two high: heads solitary or few, many-flowered (sometimes several and few-flowered): stamens 3: perianth rather larger, often dark brown, equalling or shorter than the acute capsule. Heads often very large and almost black.

A very variable species, ranging from Alaska to California and New Mexico. The typical form is mostly confined to the Coast Ranges (San Francisco to Fort Tejon), but has also been collected in Truckee Valley (*Bloomer*, *Watson*); the var. *auratus* is found on Monte Diablo (*Brewer*); var. *montanus* is a common widely distributed form eastward of the Sierra Nevada; var. *triandrus* is very similar to it, occurring in the Sierra Nevada (common in the Yosemite Valley, *Bolander*, *Torrey*) and also in the Coast Ranges, and northward to Alaska.

25. **J. phæocephalus,** Engelm. l. c. 484. A similar and very variable species, distinguished chiefly by the larger anthers, usually much exceeding the filaments and nearly equalling the perianth, and by the more closely reticulated seeds without cross-lineation; the typical form (½ to 2 feet high) has somewhat larger flowers

(about 2 lines long), usually dark brown, in few many-flowered heads: perianth-segments narrowly acuminate: style long and stigmas exserted: capsule acute: seeds ovate, comparatively large.

Var. **paniculatus**, Engelm. l. c. Heads more numerous, few-flowered, in a compound panicle: stems 1 to 3 feet high, from a stout rootstock.

The typical form near the coast, from Mendocino County to Santa Barbara; the variety in the lower Sacramento Valley and also in the Sierra Nevada (near Big Trees, *Bolander*).

26. **J. chlorocephalus**, Engelm. l. c. 485. Stems low and slender (8 to 15 inches high) from a slender rootstock, not ancipital: leaves very narrow (a line wide or less), the sheaths with ligules: heads one or two, many-flowered: perianth pale and scarious, the segments 2 lines long, very obtuse or acute: anthers as in the last species.

In the Sierra Nevada, at 4,000 to 10,000 feet altitude; mature seeds not known. Very like the form of *J. Nevadensis* with few heads, except in the pale scarious and more obtuse segments of the perianth.

27. **J. Mertensianus**, Meyer. Stems weak, from slender matted rootstocks, 6 to 18 inches high, not ancipital; leaves very narrow (a line wide or less), the sheaths with ligules: heads solitary, densely many-flowered, dark brown: perianth nearly 2 lines long, the lanceolate narrowly acuminate segments equalling the obtuse obovate capsule: anthers equalling or shorter than the filaments: seeds as in *J. xiphioides*. — Veg. Sitch. 167; Engelm. l. c. 479.

From Alaska southward in the mountains to California and Colorado; on the eastern slope of Mono Pass, at 9,000 to 10,000 feet altitude, *Bolander*.

Order CXVII. PALMÆ.

Perennial woody plants, mostly tall, with a terminal crown of large pinnately divided or flabelliform petiolate leaves sheathing the stem, and small usually diclinous and sessile flowers upon a simple or branched axillary spadix, which is at first usually enveloped in a monophyllous deciduous spathe; perianth inferior, persistent, coriaceous, of 6 segments in two series, the outer imbricate or united and cup-like, the inner mostly valvate; stamens 6 (or 3), hypogynous or perigynous, included; ovary 3-celled or of 3 distinct carpels, two of the cells or carpels often abortive; ovules 1 or 2 in each cell; stigmas short and thick, usually sessile; fruit a drupe or berry, with an often thick spongy, fleshy, or fibrous exocarp, and membranous, crustaceous or bony endocarp; seed with abundant cartilaginous or horny albumen, and a small embryo in a small basal or dorsal cavity.

A noble order of nearly 100 genera and over 1,000 species, confined almost exclusively to the tropics and the hottest portion of the temperate zone, and sparingly represented within the limits of the United States. Four species are found on the Atlantic coast, reaching as far north as lat. 33°, and a single species attains a like latitude on the western side. In the warmer regions of Mexico the species are more numerous. Scarcely any order is more remarkable for the useful purposes which its various products are made to subserve. The fruit, foliage, and timber, the fibrous tissue, the starchy pith, and the fermentable or medicinal sap are brought into use in manifold ways, and are sufficient of themselves to supply all the wants of a primitive population. No tree of the tropics is more ornamental in cultivation. The United States genera all belong to the group *Coryphinæ* or *Sabalinæ*, distinguished by their fan-shaped leaves and perfect flowers.

1. **Washingtonia.** Leaves flabelliform, copiously filiferous; petiole armed and with the ligule glabrous. Spathes and spadix glabrous. Berry small, oblong-ovate, bearing the abortive carpels at its summit. Albumen entire.
2. **Erythea.** Leaves flabelliform, sparingly filiferous; petiole armed or unarmed, somewhat pubescent; ligule tomentose. Spathes and spadix tomentose. Berry larger, globose; abortive carpels at its base. Albumen deeply pitted on the ventral side.

1. WASHINGTONIA, Wendland.

Flowers unknown except from the remains of the perianth found at the base of the fruit, which show it to be gamophyllous, with a cylindrical tube as long as the imbricate broad-rounded lobes; pedicel short. Fruit a small shortly stipitate oblong-ovate black drupe, with thin pulp and crustaceous endocarp, 1-celled, and bearing the scale-like abortive carpels on the summit at the base of the filiform persistent style. Seed oblong-ovate, somewhat flattened on the ventral side, brownish with thin testa; albumen entire, horny and oily; embryo basal. — A tree, with circular flabelliform leaves; petioles armed with stout hooked marginal spines; ligule large and appressed, coriaceous, glabrous; rhachis short; blade deeply cleft along the upper folds and copiously filiferous: paniculately branching spadix glabrous, slender and elongated, from a narrow glabrous spathe. — A Californian genus.

1. **W. filifera,** Wendl. Becoming 20 to 40 feet high, with a cylindrical trunk more or less enlarged at base (often 2 or 3 feet in diameter), and covered with the persistent bases and sheaths of dead leaves: petioles very stout, glabrous, plano-convex or slightly concave on the upper side, comparatively thin toward the margin, 2 to 5 feet long and 1 to 2½ inches broad at the summit in well developed leaves; ligule usually large and conspicuous, lacerate; blade tomentose on the margin of the (40 to 60) folds, 3 to 5 feet in diameter, cleft on the upper side nearly to the middle, the divisions terminated and margined with very numerous fine elongated fibres (often 6 to 12 inches long): flowering stems 8 to 10 feet long: fruit nearly 4 lines long, black, with thin sweet pulp: seed 3 lines long. — Bot. Zeit. xxxvii. 68. *Brahea dulcis* (?), Cooper, Smithson. Rep. 1860, 442. *Brahea filamentosa,* Hort. *Pritchardia filamentosa,* Wendl.; Drude, Bot. Zeit. xxxiv. 807; Fenzi, Bull. Soc. Tosc. Ort. i. 116, fig.

From Southern California (San Bernardino County) to Western Arizona, in rocky localities in dry sheltered cañons, solitary or few in a group. It is now cultivated for ornament in towns near the coast as far north as San Francisco, and has been extensively distributed among the gardens of Europe. The same or a very similar species (from which the above description of the flowers is drawn) was found by *Dr. E. Palmer* in the Tantillas Mountains of Lower California, near the boundary line.

2. ERYTHEA, Watson.

Flowers perfect, sessile, in a loose decompound panicle; calyx campanulate, somewhat scarious, 3-parted, shorter than the thick valvate 3-cleft corolla. Stamens 6; filaments thick, connate and adnate to the corolla, free and deltoid above and setaceously tipped; anthers small, round-oblong, obtuse. Ovary of 3 nearly distinct oblong carpels, with very short united styles; two of the carpels usually abortive. Fruit a globose black drupe, the thick fleshy endocarp somewhat adherent to the subglobose seed. Hilum at one side of the base. Albumen excavated to the middle on the ventral side and filled by the brown thickened testa. Embryo near the base. — Tall trees, with naked trunks, flabelliform plicate filiferous leaves and densely tomentose sheaths and inflorescence. Spathes sheathing. Flowers solitary or in clusters, scattered along the numerous branches of the pendent panicle. Petioles pubescent or glabrate, unarmed or with stout hooks on the margin; ligule appressed, densely tomentose; rhachis of the leaf short, and the blade deeply cleft down both the upper and lower folds and more or less fibrous on the margins.

Only the following species are known. The genus is very nearly allied to *Livistona,* of Australia and eastern Asia, which differs in its distinct filaments, oblong fruit with hard crustaceous

pericarp, broadly excavated albumen and dorsal embryo, and the leaf-segments entire or nearly so, not filiferous on the margins. Wendland refers our species to the Mexican genus *Brahea*, which has much smaller flowers, unequal filaments and comparatively large acute anthers, united carpels, oblong fruit with thin pericarp, the albumen excavated vertically nearly to the apex and embryo dorsal, and the segments of the leaves barely cleft and not fibrous on the margins. In the mythology of the Greeks, *Erythea* was one of the Hesperides, daughters of Evening or the West, "who dwelt on an island of the ocean, on the western edge of the world, and guarded a garden with golden apples."

1. **E. edulis**, Watson. The slender trunk sometimes 30 feet high and 15 inches or more in diameter, covered with a thick corky cracked bark: the fibrous sheathing bases of the leaves at length glabrous: petioles stout, over an inch broad at the summit, plano-convex with acute unarmed margins, somewhat fibrous-pubescent or glabrate above; ligule 2 or 3 inches long, very densely silky-tomentose; blade 3 feet long, the (70 or 80) folds at first tomentose, cleft to the middle (less deeply on the under side), lacerate at the apex and somewhat fibrous on the edges: panicle 4 feet long, much branched, densely tomentose, becoming glabrate: flowers numerous, in clusters of 3 or 4, the corolla (1½ lines long) twice longer than the calyx; segments of the corolla lanceolate: carpels glabrous: fruit over an inch in diameter, the thick pulp sweet and edible: seed 7 to 9 lines in diameter, slightly flattened on the inner side, with smooth and grayish, thin but very hard and bony epidermis: embryo near the base on the dorsal side. — *Brahea edulis*, Wendland; Watson, Proc. Amer. Acad. xi. 120, 146.

On Guadalupe Island (*Dr. E. Palmer*), and becoming introduced into cultivation. Each tree bears one to four panicles, blossoming late in March; the fruit-clusters are said to weigh 40 or 50 pounds.

2. **E. armata**, Watson. Taller and more graceful than the last (40 feet high): leaves glaucous, the petioles narrower, more concave above, and margined with numerous stout more or less hooked slightly spreading spines; folds (30 to 40) split nearly to the middle on both edges, scarcely lacerate at the apex and but slightly filiferous: branches of the panicle more slender: carpels densely tomentose: fruit smaller (9 lines long), the seed half an inch in diameter: embryo at the base. — *Brahea (?) armata*, Watson, l. c. 146.

In the Big Cañon of the Tantillas Mountains, Lower California, *Dr. E. Palmer*. The flowers have not been collected.

Order CXVIII. CYPERACEÆ.

Sedgy or rush-like herbs, mostly perennial and rhizomatous, with triangular or terete solid stems, and alternate mostly radical leaves with closed sheaths or leafless; spicate flowers perfect or unisexual, without perianth or with a series of hypogynous bristles or scales in its place, solitary and sessile in the axils of imbricated glume-like bracts (*scales*); stamens usually 2 or 3, hypogynous, with basifixed anthers; ovary 1-celled, with an erect anatropous ovule and a 2–3-cleft style, in fruit a lenticular or more or less triangular akene, membranous, crustaceous or bony; embryo minute, lenticular or turgid, at the base of copious albumen. — Spikelets of one to many flowers in two or more ranks, solitary or clustered, or often in simple or compound spikes or umbels or panicles, the inflorescence involucrate with usually leafy bracts or naked.

A very large order, distributed over the globe, especially abundant in the temperate and cooler portions of the northern hemisphere, and usually found in wet or damp non-saline localities. It includes 50 or 60 genera and probably 2,000 species, but is sparingly represented in California. As compared with the *Gramineæ* the order, though so large, is unimportant, the coarse herbage affording little nutriment, and no species furnishing a grain of any value.

* Flowers all perfect: spikelets few–many-flowered, solitary or spicate, the spikes capitate or umbellate: only 1 or 2 of the lower scales usually empty.

\+ Spikelets more or less flattened, the scales being in 2 ranks: inflorescence involucrate. — CYPEREÆ.

1. **Cyperus.** Perianth (bristles, etc.) none. Style slender, deciduous. Spikelets spicate or clustered.

DULICHIUM SPATHACEUM, Pers. (the only species), distinguished by its very leafy jointed stems and axillary solitary peduncles bearing sessile many-flowered spikelets, and by the linear-oblong nutlet acute with the base of the long 2-cleft style and surrounded by 6 to 9 retrorsely barbed bristles, occurs on the Columbia River and is common in the Atlantic States. The erect terete hollow culm is nearly covered by the sheaths of the short flat linear 3-ranked leaves (the lower sheaths without blades); spikelets in a 2-ranked spike, linear-lanceolate, the naked rhachis articulated at the base of each scale.

\+ \+ Spikelets many-flowered, not flattened, the scales imbricated all around. — SCIRPEÆ.

++ Style not dilated at base.

2. **Scirpus.** Spikelets solitary or clustered, or in a compound umbel, the stem often leafy at base and inflorescence involucrate. Style deciduous or only the base persistent. Barbed bristles present at base of the nutlet or wanting. Stamens mostly 3. Perennials.
3. **Eriophorum.** As *Scirpus*, but the numerous naked bristles long-exserted and silky in fruit. Spikelets few. Stamens 1 to 3. Perennial.
4. **Hemicarpha.** As *Scirpus*, but without bristles and with a minute hyaline bractlet between each flower and the rhachis. Spikelets solitary or few in a sessile apparently lateral cluster. Stamen 1. Low annuals.

++ ++ Style enlarged at base.

5. **Eleocharis.** Spikelet solitary, terminal upon a leafless bractless stem. Base of the style persistent. Bristles usually present. Stamens 3.
6. **Fimbristylis.** Spikelets in an involucrate umbel. Stem leafy at base. Style usually wholly deciduous. Bristles none. Stamens 1 to 3. Perennials.

* * Spikelets polygamous, few-flowered, ovoid or oblong-ovoid, the scales loosely imbricate all around, only the terminal ones fertile. — RHYNCHOSPOREÆ.

7. **Cladium.** Spikelets in cyme-like panicles. Stems tall, leafy. Bristles none. Style not enlarged at base, deciduous. Nutlet corky at the apex. Stamens 2. Perennial.

RHYNCHOSPORA, Vahl, is distinguished from *Cladium* by the presence of bristles and the nutlet crowned by the persistent tuberculate base of the style. R. ALBA, Vahl, has been collected in Oregon (*Hall*), a slender species with narrowly linear leaves, the lanceolate tawny spikelets in a close terminal corymb; perfect flowers 1 or 2, with 3 stamens, 9 to 12 or more bristles minutely barbed downward, and a smooth oblong-obovate nutlet bearing a long flattened awl-shaped tubercle. It is common eastward and also in Europe.

* * * Flowers monœcious, in the same or distinct spikelets, or diœcious; pistillate flowers enclosed in an inflated sac-like persistent perigynium. — CARICEÆ.

8. **Carex.** Spikelets solitary, spicate or paniculate. Hypogynous bristles or scales wholly wanting or a single short bristle at the base of the ovary.

1. CYPERUS, Linn. GALINGALE.

Flowers perfect, in few–many-flowered flattened or sometimes terete spikelets; the concave more or less carinate scales in 2 ranks, often decurrent upon the rhachis, at length deciduous, 1 or 2 of the lowest usually sterile. Hypogynous scales or bristles none. Stamens 1 to 3. Style not thickened at base, 2–3-cleft, deciduous. Nutlet lenticular or triangular, not beaked, smooth or nearly so. — Perennials or annuals, with mostly triangular and nearly naked simple stems, sheathed at base by the nearly radical leaves; inflorescence subtended by a mostly conspicuous foliaceous involucre, usually irregularly umbellate with unequal rays, the spikelets in spikes solitary or clustered upon the rays, the central spike or cluster always sessile, and the whole often contracted into a single more or less dense head.

A very large genus, numbering 500 species or more, especially abundant in tropical and subtropical regions. About 50 species are found within the limits of the United States. Most of the following sections have been by some authorities regarded as distinct genera.

§ 1. *Style 2-cleft and nutlet lenticular, the edge turned to the rhachis: spikelet flattened, many-flowered, the scales folded and sharply carinate: rhachis narrow, not winged.* — PYCREUS, Torr.

1. **C. diandrus**, Torr. Annual, with fibrous roots, and very slender triangular clustered stems ½ to 2 feet high: leaves elongated, very narrow (rarely a line wide): involucre 2 – 3-leaved: spikelets in a sessile compound cluster or in loose clusters upon the few short rays, linear-oblong, acute, 3 to 6 lines long: scales pale or brownish, thin and usually lax, rather obtuse, 1 to 1¼ lines long, twice longer than the light or dark brown oblong-ovate dull nutlet: stamens 2 or 3: style elongated, often cleft nearly to the base.

Var. **castaneus**, Torr. Scales more firm and often brown: styles less elongated, cleft to the middle. — *C. castaneus*, Bigel. *C. tenellus*, Presl, Rel. Hænk. i. 176? *C. rivularis*, Kunth, Enum. ii. 6; Boeckeler, Linnæa, xxxv. 452.

The variety only has been collected in California, in swamps near San Francisco (*Bolander*) and in the valley of the Sacramento (*Pickering*), but both forms are common in the Atlantic States and west to Texas and New Mexico. Nutlet rather longer and less pointed than in the eastern forms. It is probable that the *C. compressus*, as well as the *C. tenellus*, of Haenke's collection, reported as found at Monterey, is to be referred to this species.

§ 2. *Style 2-cleft and nutlet plano-convex, flattened parallel with the rhachis: spikelets flattened but thick, the concave scales scarcely carinate, and the broad rhachis not winged.* — JUNCELLUS, Griseb.

2. **C. lævigatus**, Linn. Perennial, with slender creeping rhizome: stems numerous, slender, 3 to 6 inches high or more, terete, naked excepting 2 or 3 short brown sheaths at base, of which the upper bears a short erect subtriangular leaf: involucre of usually 2 bracts, one erect in continuation of the culm, the other very short or wanting: spikelets 2 or 3 or more, sessile in an apparently lateral cluster, linear-oblong, many-flowered, 2 or 3 lines long, obtuse or acutish, pale green or sometimes brown: scales broad and concave, obtuse, scarcely nerved, nearly a line long: rhachis deeply pitted transversely: stamens 3: nutlet broadly obovate, ½ line long. — Boeck. l. c. 486. *C. mucronatus*, Rottb.

At Los Angeles (*Brewer*) and at hot springs near San Bernardino, *W. G. Wright*. A widely distributed species in warm regions, collected in Mexico by Hartweg, and found in Peru, the Sandwich Islands, Australia, India, at the Cape of Good Hope, and in the Mediterranean region.

§ 3. *Style 3-cleft and nutlet triangular: spikelets many-flowered, flattened with carinate scales, the rhachis naked or very nearly so.* — EUCYPERUS.

* *A small annual: spikelets with acuminate scales, in a few dense heads: stamen solitary.*

3. **C. aristatus**, Rottb. Stems ½ to 6 inches high, about equalling the flat leaves, with conspicuous involucres: spikelets linear-oblong, 2 to 5 lines long, in a dense compound sessile head or in close clusters upon 2 or 3 usually short rays: scales with strongly recurved setaceous tips, chestnut-brown, about a line long, twice longer than the oblong-obovate obtuse apiculate brownish nutlet. — *C. inflexus*, Muhl. *C. aureus*, Presl, l. c. 168.

A common species throughout the State, from Lower California to Oregon and across the continent; it is also found in Mexico, Africa and the East Indies.

C. ACUMINATUS, Torr., is somewhat taller and stouter (3 to 12 inches high), with fewer and broader oblong-ovate straw-colored spikelets, and short-acuminate spreading or very slightly recurved scales: nutlet oblong-obovate, acutish at each end. A species of the Mississippi Valley, from Illinois to Texas, which has been found in Oregon, *Hall, Howell.*

* * *Tall perennial: spikelets short, with green obtusish spreading scales, in dense heads.*

4. **C. virens**, Michx. Stout, 1 to 4 feet high: leaves and bracts of the involucre very long, broad and strongly keeled: umbel compound, often much reduced and

spikes densely crowded: spikelets ovate-oblong, acute, 2 to 4 lines long: scales acutish, obscurely 3-nerved, a line long or less: nutlet oblong, triangular, acute at each end, brown, half a line long. — *C. sordidus*, Presl, l. c. 171?

In the valley of the Sacramento (*Pickering*); perhaps also collected by *Haenke*. Otherwise known only in the Atlantic States from Delaware to Texas.

§ 4. *Style 3-cleft and nutlet triangular: spikelets many-flowered, flattened with carinate scales which are decurrent upon the rhachis as narrow wings: spikes in compound umbels.* — PAPYRUS, Kunth.

* *Wings of the rhachis soon separating to the base, scarious and scale-like. Annuals.*

5. **C. erythrorrhizos**, Muhl. Stems usually 1 to 3 feet high, stout, triangular, sometimes much reduced: leaves flat, 2 or 3 lines broad, those of the involucre (4 to 8) greatly elongated: rays 4 inches long or less, bearing a cluster of sessile simple or compound oblong spikes ½ to 1 inch long: spikelets 2 to 6 (usually 3) lines long, narrowly linear, numerous, spreading horizontally, nearly flat, bright chestnut: scales oblong, obtuse, mucronulate, acutely carinate, ½ line long, exceeding the light-colored round-ovate acutish compressed-triangular nutlet. — *C. cupreus*, Presl, Rel. Hænk. i. 172. *C. occidentalis*, Torr. Cyp. 259.

Colorado Valley (*Newberry*); near Monterey (*Haenke*); Clear Lake (*Bolander*); near Sacramento (*Pickering, Greene*); Oregon (*Douglas, Hall, Howell*), and common in the Atlantic States. Presl's species, as well as that of Torrey, was founded upon a very depauperate form.

* * *Wings of the rhachis persistently attached.*

6. **C. phymatodes**, Muhl. Perennial and fibrous-rooted, with slender root-stocks bearing small globose tubers: stems rather stout, ½ to 3 feet high, triangular: leaves nearly as long and involucral leaves elongated: umbel often compound, 4 – 7-rayed, the light chestnut-colored spikelets scattered and spreading in somewhat distichous spikes (often an inch long or more), linear, acute, 3 to 12 lines long: scales oblong, acutish, conspicuously several-nerved, thin and scariously margined, rather acutely carinate, a line long or slightly more: nutlet oblong, obtuse and obtusely triangular, ⅔ of a line long. — *C. repens*, Ell. *C. Hænkei*, Presl, l. c.?

Var. **Hermanni.** Spikes contracted and more or less clustered at the summit of the rays and involucellate: spikelets sometimes bracteate. — *C. Hermanni*, Buckley, Proc. Philad. Acad. 1862, 10.

Yosemite Valley (*Bolander*, a low form); San Luis Rey (*Parry*); Fort Yuma (*Thomas*); Truckee Valley, Nevada (*Watson*), and frequent in the Atlantic States from Canada to Texas. The variety has been found on Kern River (*Hermann*) and on the San Joaquin, *Lemmon*. The species resembles *C. esculentus* of the Old World (from the Mediterranean region to India), and has been referred to it by Boeckeler, Linn. xxxvi. 287.

7. **C. stenolepis**, Torr. Resembling *C. phymatodes* in habit; the straw-colored spikelets more slender and with fewer (4 to 8) flowers, 3 or 4 lines long, somewhat flattened or nearly terete at least when young, attenuate above; rhachis with slender joints: scales oblong, acutish, nearly 2 lines long, several-nerved, the lower usually persistent after the falling of the spikelet: spikes usually rather dense, ½ to 1 inch long, in a more or less compound umbel: nutlet linear, nearly cylindrical, obtuse, a line long, dark brown. — Cyp. 263.

In the valley of the Sacramento (*Pickering*); near Placerville (*Rattan*); in the southern Atlantic States from North Carolina and Florida to Texas and New Mexico.

§ 5. *Spikelets narrow, terete or nearly so, few to several-flowered, the scales closely appressed and the broad wings of the rhachis embracing the triangular nutlet: style 3-cleft.* — DICLIDIUM, Griseb.

8. **C. Michauxianus**, Schult. Annual: stem usually ½ to 2 feet high but often low: leaves 1 to 3 lines broad: involucres large: spikelets dull brown, some-

what flattened, 6 – 12-flowered or more, spreading in rather loose clustered spikes upon the more or less developed rays of the usually crowded umbel (often sessile on the lower stems): scales ovate, obtuse, a line long, but slightly carinate and obscurely nerved: joints of the rhachis thick, broadly winged: nutlet brownish, oblong-ovate, compressed-triangular, acute at each end.

Near Fort Yuma (*De Bary*) and in marshes along the Colorado and Gila (*Schott*); New Mexico (*Emory, Wright*), and common in the Atlantic States.

9. **C. ferax,** Richard. Stem stout and tall, with broad and much elongated involucral leaves, and bearing an open spreading compound umbel of numerous rays: spikelets pale, scattered, horizontally spreading in loose subdistichous spikes, terete, 5 to 10 lines long, usually 8 – 10-flowered: scales oblong-ovate, obtuse, strongly concave and scarcely carinate, obscurely 7 – 9-nerved, nearly 1½ lines long, at length spreading, twice longer than the thick broadly winged joints of the rhachis: nutlet obovoid-oblong, obtuse and obtusely triangular, closely embraced by the wings. — Kunth, Enum. ii. 89; Benth. Fl. Austr. vii. 286.

A species widely spread through the tropical regions of the globe; collected in California only by *Muir*, the locality unknown.

§ 6. *Spikelets 1 – 3-flowered, slender and subterete, often flexuous, acute or acuminate (the upper flower usually undeveloped): scales appressed, obtuse, several-nerved: joints of the rhachis short, slender, narrowly winged: style 3-cleft and nutlet triangular.* — Mariscus, Griseb.

* *Spikelets scattered in open spikes: umbel compound.*

10. **C. Californicus.** Stem stout and tall, triangular: involucre about 5-leaved, the leaves much elongated, nearly 6 lines broad, very rough on the margins: rays about 10, elongated (4 inches), bearing involucellate umbels with slender rays an inch long or less: spikes 1 to 1½ inches long, the spreading or somewhat reflexed flexuous spikelets terete, attenuate upward, very slender, 2 to 4 lines long, 2 – 4-flowered: scales oblong-ovate, a line long: nutlet unknown. — *C. speciosus,* Torr. Bot. Mex. Bound. 226.

Collected in California by *Rev. Mr. A. Fitch*, but locality uncertain. In habit resembling forms of the eastern *C. strigosus.*

* * *Spikelets in dense cylindrical sessile spikes.*

11. **C. flavamariscus,** Griseb. Perennial, with creeping rootstock: stems usually slender, acutely triangular, 1 or 2 feet high, exceeding the leaves: involucre 3 – 4-leaved: spikes about 5 (4 to 6), very dense, 6 to 8 lines long: spikelets spreading, oblong-lanceolate, acute, 1½ lines long, 2-flowered, 1-fruited: scales yellowish or brownish, ovate, about 11-nerved: nutlet triangular-obovate, ⅔ of a line long. — Fl. Brit. W. Ind. 567. *Mariscus flavus,* Vahl. *M. Hænkei,* Presl, Rel. Hænk. i. 181. *C. flavus,* Boeckeler, Linn. xxxvi. 384.

From Mexico and the West Indies to Brazil; reported as collected by Haenke at Monterey. *C. pubescens,* Presl, of the same collection and from the same locality, may perhaps be a radiate form of this species, though described as pubescent throughout, which is a character otherwise unknown in the genus.

2. SCIRPUS, Linn. Bulrush or Club-Rush.

Flowers perfect. Spikelets usually many-flowered, with the scales imbricately and closely arranged around the rhachis, the lowest one or two often empty. Hypogynous bristles 3 to 6, barbed or ciliate, or wanting. Stamens 1 to 3. Style 2 – 3-cleft, scarcely or not at all thickened at base, deciduous or only the base persistent. Nutlet lenticular or more or less triangular, obovoid. — Tufted annuals or mostly perennials with creeping rootstocks, the stems sheathed or leafy at base, and

the spikelets in a terminal (or apparently lateral) involucrate cluster or compound umbel-like panicle, or solitary.

A cosmopolitan genus of nearly 250 species, of which about 30 are found in the United States.

§ 1. *Spikelet solitary, small, with a single erect involucral bract: bristles none: stems low and slender.* — Isolepis, Benth.

1. **S. riparius,** Spreng. Stems tufted, from fibrous roots, very slender and often setaceous, 2 to 6 or rarely 10 inches high, sheathed at base, the upper sheath usually bearing a short slender leaf: involucral bract 1 to 10 lines long or nearly wanting: spikelet ovate to oblong-ovate, 1½ to 2½ lines long: scales pale or often deep brown, with a pale prominent midvein, concave, obtuse or pointed: stamens usually 3: style 3-cleft: nutlet triangular-obovoid with distinct angles, the sides convex, smooth or minutely granular, not striate nor ribbed, dark brown when mature, less than half a line long. — Benth. Fl. Austr. vii. 327. *Isolepis riparia,* R. Br.; Hook. f. Fl. Tasm. ii. 89, t. 145. *S. Savii,* Reichenb. Icon. Fl. Germ. viii, t. 301. *Isolepis leptocaulis,* Torr. Pacif. R. Rep. iv. 153. *S. pygmæus,* Gray, Proc. Amer. Acad. vii. 392. *S. setaceus,* Linn., var., Boeckeler, Linnæa, xxxvi. 500.

Frequent in marshy places near the coast from Santa Barbara to Oregon; also in South America, Australia, Africa and the Mediterranean region.

2. **S. carinatus,** Gray, l. c. Resembling the last in habit, the slender stems triangular and channelled, 1 to 4 inches high, with a short leaf at base: spikelet (rarely 2 or 3) greenish or tinged with brown, 5 – 10-flowered; scales in 4 ranks, very broadly ovate, strongly carinate and boat-shaped, acute, gibbous in fruit and retaining the brown nutlet, which is very broad, acutely triangular, smooth, over half a line long, with a broad scar at the summit. — Boeck. l. c. 498. *Isolepis carinata,* Hook. & Arn.; Torr. Cyp. 349. *I. koilolepis,* Steud. Cyp. 318.

In swamps about San Francisco, abundant with the last (*Bolander*); Santa Rosa Creek (*Bigelow*); Mendocino County (*Bolander*); in the Gulf States, from Alabama to Arkansas and Texas.

§ 2. *Bristles present, retrorsely barbed or ciliate, not elongated: stems mostly tall and stout.* — Euscirpus, Benth.

* *Inflorescence apparently lateral, with a single erect involucral leaf.*

+ *Stem terete or nearly so.*

++ *Stem leafy at base: spikelets in a sessile cluster.*

3. **S. Nevadensis,** Watson. Stems clustered, from a running rootstock, a foot or two high, very slender, somewhat flattened above: leaves nearly equalling the stem, deeply channelled or revolute, very rough on the margins, sharply acute: spikelets 1 to 8, ovate-oblong, acute, 4 to 10 lines long; scales brown and shining, ovate, slightly carinate, acutish: bristles 1 to 3, not half the length of the nutlet: style 2-cleft: nutlet broadly ovate, plano-convex, acute, a line long. — Bot. King Exp. 360.

Borders of Mono Lake, on alkaline soil (*Brewer,* n. 1846); at Soda Lake, Nevada, *Watson.*

++ ++ *Stem leafless or nearly so: spikelets umbelled.*

4. **S. lacustris,** Linn. Stem stout and tall, from creeping rootstocks, terete or very obtusely triquetrous above, leafless or the upper basal sheaths with a short terete leaf: involucral bract stout, shorter than the inflorescence: spikelets numerous, solitary or more or less clustered, in an irregularly compound umbel, oblong-ovoid, 3 to 6 lines long; scales broadly ovate, very obtuse or usually emarginate and mucronate, ciliate: bristles usually 6, slender with scattered barbs, about equalling the obovate plano-convex nutlet: style usually 2-cleft. — Reichenb. l. c., t. 306 – 308; Boeck. l. c. 712; Benth. l. c. 333. *S. validus,* Vahl.

Var. **occidentalis.** Scales often pubescent, especially on the midvein, usually pale with fine brown lines: filaments at length broad and exserted: bristles not exserted: nutlet broadly obovate, rounded at the summit, terminating abruptly in a rather short beak.

The species is widely distributed, under several forms, being found in Europe and Asia, temperate and tropical North America, the Sandwich Islands, New Zealand and Australia. Only the variety is found in California, ranging from San Diego County to British Columbia and eastward to Texas and Colorado. In common with the next it is familiarly known under the name of "Tule," occupying large areas in overflowed bottom-lands and marshy places throughout the State. It is sometimes 8 to 12 feet high and an inch or more in diameter at base. The eastern form (*S. validus*, Vahl), of the Atlantic States (from Lake Winnipeg to Florida) and the West Indies, has rather smaller and broader spikelets, shorter and narrower filaments, bristles at length exserted, and a narrower nutlet somewhat attenuated at top.

5. **S. Tatora**, Kunth. Very closely resembling the last, but readily distinguished by the bristles of the perianth, which are 2 to 4, very dark brown, stout or somewhat flattened and retrorsely plumose with short curved hairs, shorter than the nutlet: scales brown, not pubescent: filaments broad, rarely exceeding the nutlet, which is narrowly obovate, shortly attenuate into the stout beak. — Enum. ii. 166. *Elytrospermum Californicum*, C. A. Meyer, Cyp. Nov. 7, t. 2. *S. riparius*, Presl, Rel. Hænk. i. 193, not Spreng. *Malachochate riparia*, Nees & Meyen; Gay, Fl. Chil. vi. 176, t. 7. *S. pseudotriqueter*, Steud. Cyp. 86.

From the Sacramento Valley to Mexico and eastward to Louisiana; also in South America from Peru and Chili to Brazil.

+ + *Stem acutely triangular or triquetrous.*

++ *Stem leafless or with a single short leaf at base: involucral bract stout and triangular.*

6. **S. Olneyi**, Gray. Stem stout, 2 to 7 feet high, from a stout running rootstock, more or less deeply triquetrous or wing-angled, continued as involucre an inch or less beyond the inflorescence: spikelets 2 to 12 in a crowded sessile cluster, oblong-ovate, acute or rather obtuse, 2 to 6 lines long, usually short: scales thin, brown, broad and obtuse, glabrous or slightly ciliate: anthers shortly acute: bristles 4 or 6, rather shorter than the narrowly obovate plano-convex prominently beaked nutlet: style 2-cleft. — Pl. Lindh. 30. *S. pungens*, Benth. Pl. Hartw. 27. *S. triqueter* (?), Torr. Pacif. R. Rep. iv. 153.

From San Francisco (*Bigelow*) to San Diego and across the continent; Mexico, *Gregg*, *Hartweg*.

++ ++ *Stem somewhat leafy: leaves obversely flattened, channelled: involucral bract more slender and channelled.*

7. **S. pungens**, Vahl. Stem usually slender, 1 to 4 feet high, acutely triangular: leaves 1 to 4, shorter than the stem; the more or less channelled bract 1 to 4 inches long: spikelets 1 to 6, closely crowded, ovate to ovate-oblong: scales brown, often very dark, broadly ovate, emarginate and usually conspicuously tipped with a straight awn: anthers narrowly acuminate: bristles 2 to 6, shorter than the obovate plano-convex prominently beaked nutlet, which is somewhat narrowed at base, nearly 1½ lines long: style 2- rarely 3-cleft. — Boeck. l. c. 708. *S. badius*, Presl, Rel. Hænk. i. 193. *S. Rothii*, Hoppe; Reichenb. l. c., t. 304.

Less frequent than the preceding in California, though common in the Atlantic States: Arroyo del Puerto (*Brewer*); Monterey, near the sea (*Hænke*, *Brewer*); Mono Lake and the Great Salt Lake, and southward into Mexico; also in South America and the West Indies, in Australia, and the western Mediterranean region.

* * *Involucre foliaceous, spreading: stems triangular, leafy at base: leaves flat.*

+ *Spikelets large, few, in a sessile cluster or sparingly umbellate, rufous.*

8. **S. maritimus**, Linn. Stems stout, 1 to 3 feet high, from running often tuberiferous rootstocks: leaves equalling or exceeding the stem; involucral bracts

unequal, one much the longer and more erect: spikelets ovate to oblong-ovate, acute, 5 to 10 lines long: scales ovate, 2 or 3 lines long, dull brown, emarginate, tipped with a long slender soon recurved awn: bristles 1 to 6, unequal, deciduous, or sometimes none: filaments elongated; anthers 2 lines long: style mostly 3-cleft: nutlet broadly obovate, plano-convex or slightly angled on the back, obtuse and only slightly apiculate, 1½ lines long. — Reichenb. l. c., t. 310, 311; Benth. Fl. Austr. vi. 335. *S. robustus*, Presl, l. c. 194.

In saline localities throughout the State and northward to British Columbia, as well as eastward across the continent. The species is found under several forms in most of the temperate and tropical regions of the globe.

+ + *Spikelets small, numerous, greenish or lead-colored, in a compound or decompound umbellate panicle.*

9. **S. sylvaticus**, Linn. Stem stout, 2 to 5 feet high, obtusely triangular, leafy to the top: leaves broad (usually half an inch wide), elongated; involucre of similar bracts: panicle decompound, large and open, the spikelets in clusters terminating the branches and in the axils, 1½ to 2 lines long, oblong-ovate: scales ovate-lanceolate, obtuse or sometimes acute: bristles barbed to the base, about equalling the small (½ line long) pale nutlet, which is obovate, plano-convex, slightly angled on the back, abruptly short-beaked: styles 3-cleft. — Reichenb. l. c., t. 313.

Var. **digynus**, Boeck. Style bifid and the nutlet not at all angled on the back: stamens 2 and bristles 4. — Linnæa, xxxvi. 727. *S. microcarpus*, Presl, l. c. 195; Gray, Manual, 564. *S. lenticularis*, Torr. Cyp. 328.

Only the variety has been collected in California, where it is rather frequent, ranging from San Diego County (Cuiamaca Mountains, *Palmer*) to British Columbia, and across the continent northward. The typical European form is collected rarely in New England.

10. **S. atrovirens**, Muhl. Very similar to the last: panicle more contracted, the smaller spikelets (1½ lines long) crowded in denser and larger clusters: scales narrower and narrowly acuminate: bristles scarcely barbed below the middle: style 3-cleft: nutlet oblong-obovate, more acuminate, slightly angled on the back. — *S. sylvaticus*, var. *atrovirens*, Boeck. l. c.

Plumas County (*Mrs. Austin*); Oregon (*Howell*); Colorado, and eastward from the Saskatchewan and Indian Territory to New England.

§ 3. *Bristles elongated, the barbs directed upward: stem leafy, bearing a sessile head of spikelets subtended by a few involucral scales.*

11. **S. criniger**, Gray. Stems slender, 3 inches to 2 feet high or more, from densely matted rootstocks, triangular and striate, rough above: leaves flat, rough on the margins, the radical one elongated but shorter than the stem, the cauline only an inch or two long, distant, the uppermost usually very near the top: involucral bracts broad and scale-like, acuminate, 2 to 4 lines long: spikelets 5 to 9, oblong, 3 or 4 lines long; scales thin and soft, brownish, oblong: filaments very slender, much exserted and exceeding the six bristles: style 3-cleft: nutlet oblong, triangular, acute and shortly beaked, a line long. — Proc. Amer. Acad. vii. 392.

In the Sierra Nevada; Wood's Peak, above Amador Pass near snow (*Brewer*); Plumas County (*Mrs. Austin*); Modoc County (*Miss S. A. Plummer*) — also in the Red Mountains of Mendocino County, *Bolander*. The bristles are not naked and silky as is the case in § *Trichophorum*.

3. ERIOPHORUM, Linn. Cotton-Grass.

Bristles usually very numerous, naked, silky, becoming greatly elongated. Otherwise as *Scirpus*. — Spikelets single or clustered or umbellate, usually involucrate with erect scale-like bracts, upon a leafy or naked stem; scales membranaceous, 1–3-nerved. Style very slender and elongated, 3-cleft. Nutlet acutely triangular. Perennials with creeping rootstocks.

A small genus, of only 6 or 8 species, peculiar to northern temperate and arctic regions. Nearly all are common to North America and the Old World.

1. **E. gracile**, Koch. Stems very slender, a foot or two high, terete or slightly triangular, with one or more erect very narrow triangular leaves: involucre of 2 or 3 erect brownish ovate-lanceolate bracts or the lowest somewhat foliaceous: spikelets 2 to 5, on short tomentose-scabrous slightly nodding rays (usually a half-inch long or less), oblong, 3 or 4 lines long; scales ovate, obtuse, slate-colored or brownish: nutlet linear-oblong, broadest above, $1\frac{1}{3}$ lines long. — Reichenb. Icon. Fl. Germ. viii, t. 290.

Swamps near Santa Rosa, Sonoma County (*Bigelow*); Big Trees (*Hillebrand*); Sierra County (*Lemmon*); eastward in the northern border States and Canada, and also European.

E. POLYSTACHYUM, Linn., has been collected in marshes near Mount Hood (*Howell*) and may enter California. It is a stouter species, with mostly flat linear leaves and a more conspicuous involucre; spikelets more numerous and larger, upon longer nodding and usually smooth rays; nutlet broader. The most common species eastward and in Europe, under several forms.

4. HEMICARPHA, Nees.

Distinguished from *Scirpus* § *Isolepis* by a minute hyaline scale at the base of the flower on the side next to the rhachis of the spikelet. Hypogynous bristles none. Stamen 1, anterior to the ovary and more or less lateral. Style 2-cleft. Nutlet oblong-obovate, nearly terete. — Low or dwarf setaceous annuals, with flattened stems, somewhat leafy at base, bearing 1 to 3 small spikelets sessile in an involucrate cluster.

Besides the following American species there is another found at the Cape of Good Hope and in the East Indies, and perhaps one or two more. Boeckeler refers the species all to *Scirpus*, considering the hypogynous scale as only a sterile filament or staminodium. Its constant position next to the axis and its insertion below that of the stamen seem, however, to indicate the probable correctness of the view taken by Nees.

1. **H. subsquarrosa**, Nees. Stems numerous, tufted, 1 to 6 inches high, brown-sheathed at base, with 1 or 2 very short filiform leaves: principal involucral bract continuous with the stem, often $\frac{1}{2}$ to 1 inch long, the others much smaller or none: spikelets 1 to 3, brownish, ovate, 1 to $1\frac{1}{2}$ lines long; scales numerous, cuneate-obovate, shortly acuminate and slightly spreading at the tip or erect, very small, little exceeding the obtuse nutlet ($\frac{1}{4}$ of a line long). — Fl. Bras. i. 61, t. 4, fig. 1. *Scirpus subsquarrosus*, Muhl. *S. micranthus*, Vahl; Boeck. in Linnæa, xxxvi. 49.

Valley of the Sacramento (*Pickering*); Arizona (*Rothrock*); New Mexico, and eastward through the Atlantic States; also in Mexico and Brazil. The delicate scale above the ovary varies much in form, often broadly cuneate-obovate and investing the ovary, somewhat adherent to the nutlet, truncate or acutely 3-toothed and faintly 3-nerved, or sometimes narrow and 2-cleft nearly to the base, and sometimes apparently wholly wanting.

2. **H. occidentalis**, Gray. Similar in habit, but the stems only an inch or two high: spikelets greenish, broadly ovate, with spreading lanceolate long-acuminate scales nearly a line long and twice longer than the nutlet: hyaline scale truncate or erosely toothed, 2 – 4-nerved, shorter and not adherent to the nutlet. — Proc. Amer. Acad. vii. 391.

Yosemite Valley (*Bolander*); foothills of the Sierra Nevada, *Lemmon*.

5. ELEOCHARIS, R. Brown. SPIKE-RUSH.

Flowers perfect, usually many, in a solitary naked spikelet terminating a leafless stem; scales closely imbricated all around the rhachis, rarely somewhat distichous or 3-ranked, only 1 or 2 of the lower scales sometimes empty. Perianth of 3 to 9 (usually 6) short retrorsely barbed bristles, rarely none. Stamens mostly 3. Style

usually 3-cleft, the conical or flattened tuberculate base persistent and mostly jointed upon the summit of the turgid-triangular or lenticular nutlet. — Stems tufted, from matted or creeping rootstocks, terete or angular, the base covered with closely appressed sheaths. Lower scale of the spikelet sometimes enlarged and bract-like.

A genus of nearly a hundred species, distributed over the tropical and temperate regions of the globe, a few even arctic. Twenty species or more are found in North America. The genus is referred by some authorities to *Scirpus*, and on the other hand is divided into several by Nees and others.

* *Spike small and few-flowered, the scales somewhat distichous or only 3-ranked: style 3-cleft and nutlet triangular. Low and slender.*

+ *Tubercle contracted at its junction with the nutlet.*

1. **E. acicularis,** R. Br. Stems tufted, with fibrous roots and very slender running rootstocks, usually setaceous, 1 to 8 inches high: spike 3 – 9-flowered, 1 to 3 lines long; scales ovate-oblong, acutish, ½ to 1 line long, more or less deeply tinged with brown: bristles 3 or 4, often wanting: nutlet oblong-obovate, obscurely triangular and faintly ribbed on the sides, half a line long; tubercle broad, short and blunt. — *Scirpus acicularis,* Linn.; Reichenb. Icon. Fl. Germ. viii, t. 294.

A common species, on sandy or muddy stream-banks, from Santa Barbara (*Rothrock*) to British Columbia (*Lyall*), and across the continent; also in Mexico, and in Europe and Asia.

2. **E. pygmæa,** Torr. Stems an inch or rarely 2 to 4 inches high, flattened and grooved: spike 2 – 4-flowered, rarely more, greenish, the lowest scales usually somewhat the largest: bristles often wanting: nutlet obovate, acutely triangular, smooth and shining. — Cyp. 313, and Pacif. R. Rep. iv. 152.

Near Cocomungo (*Bigelow*), as referred by Dr. Torrey, though the specimens are too young for positive determination. The species is found in brackish marshes in the Atlantic States and westward to New Mexico. Boeckeler refers it to the European *Scirpus parvulus.*

+ + *Tubercle continuous with the nutlet and not contracted at base.*

3. **E. pauciflora.** Stems tufted, erect, from slender running rootstocks, 3 to 8 inches high, striate: spike ovate-oblong, 2 or 3 lines long, the dark brown oblong acute scales nearly 2 lines long: bristles 3 to 6, usually equalling the nutlet: filaments and stigmas long-exserted: nutlet oblong-obovate, obtusely triangular, a line long excluding the rather stout pyramidal tubercle, which is nearly a third as long as the nutlet. — *Scirpus pauciflorus,* Lightf.; Reichenb. l. c., t. 299; Gray, Manual, 560.

Soda Springs, head of Tuolumne River (*Brewer*); Klamath Valley (*Gabb, Kronkhite*); Wyoming and Colorado, and in the northern Atlantic States; also in Europe and Asia. The species has usually been included under *Scirpus,* but there appears to be no good reason for separating it from *Eleocharis,* inasmuch as it has all of the characters which distinguish that genus from *Scirpus.* The tubercle is identical in character with that of *E. rostellatus* and its allies, and such as is not found in *Scirpus,* where the style is slender and never tubercle-like at base.

* * *Spike terete, many-flowered.*

+ *Tubercle somewhat contracted at its junction with the nutlet.*

++ *Style 2-cleft and nutlet lenticular.*

4. **E. palustris,** R. Br. Stems usually slender, from running rootstocks, terete, striate, ½ to 4 (usually 1 or 2) feet high: spike oblong-lanceolate to linear, acute, 3 to 12 lines long; scales ovate-oblong or the lowest ovate, obtuse or the upper acutish, thin, brown with white margin and greenish keel: bristles 4, about equalling the obovate turgid smooth nutlet, which is a line long including the broad-deltoid acutish or acute, rarely acuminate tubercle. — *Scirpus palustris,* Reichenb. l. c., t. 297.

Very common in water or wet grounds and very widely distributed, being found throughout the United States and British America, and in most parts of the Old World.

E. OLIVACEA, Torr., with very slender tufted spreading stems 1 to 6 inches high, ovate or oblong-ovate spikes 1 to 3 lines long, and a similar nutlet nearly a half-line long but shorter than the 6 or 8 bristles, has been collected in Colorado (*Greene*) and Oregon (*Hall*), and will probably be also found in Northern California. The Oregon specimen has shorter bristles than the eastern form, and the tubercle is less sharply contracted at base.

++ ++ *Style 3-cleft and nutlet triangular.*

5. **E. arenicola,** Torr. Stems very slender, sulcate, 6 to 18 inches high, from rather slender running rootstocks, erect or sometimes reclining and rooting at the extremity: basal sheaths brown, becoming nearly black: spike ovate or usually oblong, 2 to 5 lines long, the numerous closely imbricated scales ovate and very obtuse, thin, brown with greenish midvein and pale border: bristles 4 or 6, about equalling the very obtusely triangular oblong-obovate nutlet, which is nearly ½ of a line long: tubercle much broader than the apex of the nutlet, thick, deltoid, acute. — Pl. Lindh. 29, and Bot. Mex. Bound. 228. *E. Dombeyana*, Boeck. in Linn. xxxvi. 450, as to Drummond's plant.

Frequent in Southern California; at hot springs near San Bernardino (*Wood, W. G. Wright*); Santa Barbara (*Rothrock*, n. 58); Los Angeles (*Nevin*); Cuiamaca Mountains (*Palmer*, n. 386); also collected by *Coulter*, n. 799. It is common eastward from New Mexico (*Wright*, n. 1958, 1959) to South Carolina and Florida, and is the *E. Engelmanni* of Hall's Texan collection (n. 696), but not of Steudel, which is a form of *E. obtusa*. The Mexican *E. truncata*, Schlecht. (*E. montana*, Benth. Pl. Hartw. 27), which Boeckeler also refers to the Peruvian *E. Dombeyana*, Kunth, is much like the present species, but has larger and less crowded scales, and a somewhat larger and broader nutlet, with longer bristles.

+– +– *Tubercle continuous with the nutlet and not at all constricted at base.*

++ *Tubercle flattened, broader than long.*

6. **E. obtusa,** Schult. Stems tufted, numerous and erect, from fibrous roots, 6 to 15 inches high, nearly terete, striate: spike ovate and obtusish to oblong and acute, 2 to 5 lines long; scales very numerous and densely crowded, ovate-oblong, obtuse, brown with a paler margin, a line long: style 2-cleft: bristles 6 or 8, nearly twice longer than the obovate lenticular shining nutlet, which has somewhat thickened margins, the broad summit bearing a broadly deltoid tubercle. — Gray, Manual, 558.

In the Yosemite Valley (*Bolander*); Plumas County (*Mrs. Ames*); Oregon (*Howell*); Cascade Mountains (*Lyall*); common in the Atlantic States from Canada to Florida. Referred by Boeckeler erroneously to the European *E. ovata*. It much resembles the last species, but is at once distinguished by the nutlet.

7. **E. Bolanderi,** Gray. Stems tufted, from rather thick rootstocks, very slender, 3 to 10 inches high: spike oblong-ovate, acute, 2 or 3 lines long; scales dark brown, ovate, obtuse, rather few, in 3 or 4 ranks: style 3-cleft: bristles 3 or 4, unequal, very short, several times shorter than the nutlet, which is obtusely triangular, oblong-obovate and compressed, with a short broadly deltoid tubercle. — Proc. Amer. Acad. vii. 392.

On stream-banks near Clark's, Mariposa County (*Bolander*), and in the Sierra Nevada near snow, *E. L. Greene.*

++ ++ *Tubercle pyramidal-subulate, longer than broad.*

8. **E. rostellata,** Torr. Stems slender, compressed, strongly sulcate, 1 to 2½ feet high, often rooting and proliferous at the apex: basal sheaths light-colored: spike oblong, 3 to 5 lines long, rather few-flowered; scales light brown or straw-color, ovate, obtuse, somewhat rigid and carinate, nearly 2 lines long: style 3-cleft: bristles 6, exceeding the obovate obtusely triangular nutlet, which is 1½ lines long including the stout narrowly pyramidal tubercle (half as long as the nutlet).

Var. **occidentalis.** Nutlet narrower, oblong-obovate: bristles mostly shorter.

Near Fort Tejon (*Dr. Horn*) and in San Bernardino County, *Parry & Lemmon*, n. 398. The typical form belongs to the Atlantic States.

6. FIMBRISTYLIS, Vahl.

Flowers perfect, usually numerous, the scales closely imbricated around the rhachis of the spikes, which are solitary or in clusters usually in a simple or compound involucrate umbel upon a stem leafy at base. Perianth none. Stamens 1 to 3. Styles 2–3-cleft, often flattened and ciliate, somewhat dilated at base, at length wholly deciduous from the nutlet, or the base rarely persistent. Nutlet lenticular or triangular, usually attenuate at base or substipitate.

A genus of 150 species or more, chiefly of tropical or subtropical regions, barely a half-dozen occurring within the limits of the United States.

* *Spikes umbellate, solitary.*

+– *Style 2-cleft, flattened and ciliate: nutlet lenticular: tubercle soon deciduous.*

1. **F. thermalis,** Watson. Stems from short matted rootstocks, a foot or two high, flattened and more or less scabrous, striate: leaves 1 or 2 lines broad, flat becoming channelled or revolute, more or less pubescent, very rough on the margin: involucres and involucels of several linear-subulate acuminate scabrous bracts shorter than the rays (½ to 1 inch long): spikes 2 to 8 (rarely only the central sessile one), ovate to linear-oblong, 3 to 10 lines long; scales dull brown, pubescent, ovate, obtuse, mucronate: stamens 2 or 3: nutlet obovate, obscurely striate, ⅔ of a line long. — Bot. King Exp. 360.

Margins of hot springs, near Kernville (*Rothrock*, n. 303) and San Bernardino (*W. G. Wright*), and in Ruby Valley, Nevada (*Watson*); first collected by *Brewer* (n. 2832), at warm springs in Owen's Valley.

Presl (Rel. Hænk. i. 192) describes another species of this group under the name of *F. verrucosa*, the typical form of which is doubtless *F. diphylla*, Vahl (*F. laxa*). His variety β, said to have been collected at Monterey and also credited to Mexico, with nutlet longitudinally costate, transversely striate, and tuberculate toward the top, is more uncertain and probably not from California.

+– +– *Style 3-cleft, filiform and not ciliate: nutlet acutely triangular.*

++ *Tubercle soon deciduous: nutlet granular-tuberculate.*

2. **F. miliacea,** Vahl. Apparently annual: stems tufted, 4-angled, ½ to 2 feet high, very leafy at base: leaves with broad open sheaths, linear, very narrowly attenuate upward: umbel diffusely compound, the involucres and involucels of several filiform bracts broad at base: spikelets subglobose, about a line long; scales numerous, closely imbricated, pale brown, broadly ovate, obtuse: stamen 1: nutlet very small, obovoid, whitish, 3-ribbed and muricate-tuberculate.

A species of tropical Asia and Australia, collected near San Francisco (*A. Wood*), but doubtless introduced.

Gussonia cyperoides, Presl, l. c. 183, t. 33, described as from Monterey, California, is referred to *Abildgaardia* by both Nees and Kunth, and with evident correctness, nor does the species seem to differ at all from a few-flowered form of *A. fusca*, Nees. Mr. Bentham in the Flora Australiensis includes *Abildgaardia* as a section under *Fimbristylis*, distinguished by its flattened distichous spikelets; otherwise its characters correspond nearly with those of the present group. Inasmuch as the localities of Haenke's collections are known to have been much confused and not to be relied upon as given by Presl, it is probable that his specimens of this species were not collected in California. Should it be found, however, it may be known by its lanceolate 2-ranked spikelets, with carinate scales decurrent upon the short joints of the rhachis in the manner of *Cyperus* § *Mariscus;* stamens 3; nutlet densely tuberculate.

++ ++ *Tubercle more or less persistent: nutlet faintly wrinkled transversely.*

3. **F. capillaris,** Gray. Annual, tufted, the bristle-like stems 2 to 10 inches high, much exceeding the filiform leaves: umbel simple or compound, rarely reduced to a single apparently lateral spikelet: involucral bracts short, setaceous: spikelets oblong-ovate, few-flowered, 1 to 3 lines long; scales dark brown with green midvein, ovate, acutish: stamens 2: nutlet broadly obovate and rather acutely

triangular, $\frac{1}{3}$ of a line long, usually bearing the small deltoid tubercle. — Manual, 567; Benth. Fl. Austr. vii. 322. *Scirpus capillaris*, Linn.; Boeck. Linnæa, xxxvi. 759.

In the Yosemite Valley (*Bolander*); Oregon (*Hall*); Arizona (*Rothrock*); common eastward, as well as in most tropical and subtropical regions.

* * *Spikes clustered: style 2-cleft, slender: nutlet lenticular, without tubercle.*

4. **F. apus.** Annual, cespitose, dwarf, and nearly acaulescent: leaves and involucral bracts an inch or two long, light green, flat-filiform, roughish, with whitish dilated bases: spikelets in nearly sessile clusters, lanceolate, 2 lines long; scales lanceolate, acuminate, pale and thin with a strong midvein: stamen 1: nutlet obovate, nearly white, very faintly tuberculate. — *Scirpus apus*, Gray, Proc. Amer. Acad. x. 78.

Shores of Clear Lake, *Bolander*.

F. JUNCIFORMIS, Kunth (*F. brevifolia*, Presl, Rel. Hænk. i. 192, changed to *F. brachyphylla*, l. c. 351; *F. Hænkei*, Dietr.), is an East Indian species with small clustered spikes in an open umbel, and a very small triangular tuberculate nutlet; though reported as from Monterey in Haenke's collection it is probably not Californian.

7. CLADIUM, P. Browne. SAW-GRASS.

Spikelets small, usually clustered, in terminal and lateral mostly compound corymbs, panicles or cymes, of about 5 closely imbricated brown scales, the lower empty, the terminal one fertile, and the one or two below it staminate. Perianth none. Stamens 2 or 3. Style 2–3-cleft, somewhat thickened at base continuous with the ovary. Nutlet ovate or oblong-ovate, smooth, acute with the scarcely distinguishable persistent base of the style. — Perennials with stout rhizomes, the typical species with tall stout stems leafy throughout with elongated channelled leaves.

The genus proper is limited to three species, one belonging to Europe, Asia and Australia, to which the Californian form is referred, and two to the Atlantic States and the West Indies, though one of these (*C. effusum* or *occidentale*) is also placed in *C. Mariscus* by Boeckeler. To these is added an Old World (chiefly Australian) group of 15 or 20 species, less leafy or leafless, and with the nutlet usually more triangular.

1. **C. Mariscus**, R. Br. Stems numerous, in dense tussocks, very stout: leaves equalling the stem, a half-inch broad or more, strongly ribbed, channelled above, very sharply and rigidly serrate on the edges and keel: lateral panicles usually 6 or 8, from the axils of short sheathing channelled triangular-tipped leaves: spikelets light brown, in numerous clusters of 2 or 3, narrowly oblong, 2 or 3 lines long; scales ovate to lanceolate, usually very obtuse: stamens 2: upper flower perfect, the next lower only staminate: nutlet brown, ovate, attenuate upward, $1\frac{1}{2}$ to 2 lines long, with a truncate circular somewhat cup-shaped base. — Reichenb. Icon. Fl. Germ. viii, t. 287; Benth. Fl. Austr. vii. 402.

Var. **Californicum.** Stems 6 to 8 feet high, with diffuse drooping panicles: lower scales ovate and acutish or acute, the upper lanceolate and acute or acuminate. — *C. effusum*, Watson, Cat. Pl. Wheeler, 18.

The variety has been collected in a swamp near San Gabriel (*Brewer*) and in Southern Nevada, *Wheeler*. Prof. Brewer describes the stems as nearly an inch in diameter at base, and the hummocks which it forms as 4 or 5 feet high and $1\frac{1}{2}$ to 2 feet thick. It much resembles the larger flowered and fruited European form, but has remarkably acute and rather strongly nerved scales.

8. CAREX, Linn. SEDGE. (By WILLIAM BOOTT, Esq.)

Flowers diclinous. Spikelets monœcious or androgynous or rarely dioecious, several-flowered, the male simple, the female sometimes compound; scales equally imbricated around the axis, 1-flowered. Stamens 2 or 3. Perigynium a more or less

inflated sac enclosing the ovary, with rarely an hypogynous bristle (*racheola*) between them. Style 1 : stigmas 2 or 3. Nutlet lenticular, plano-convex, or triangular. — Perennial herbs, with triangular stems, more or less scabrous on the angles, rarely smooth. Spikelets terminal and solitary or with additional ones borne in the axils of leafy or scale-like often sheathing bracts. Leaves grass-like, commonly rough on the margins and keel.

The largest genus of the order, including nearly 700 species, abundant in the temperate and cooler regions of both hemispheres and occurring more sparingly in mountainous districts within the tropics. About 180 species are found in the Atlantic States (many of them also of the Old World), and the flora of the interior region adds some others. The following key embraces only such as have been detected within the limits of California. The genus is a very intricate one and the determination of species often difficult or even impossible in the case of imperfect or immature specimens. In collecting, care should be taken to secure mature fruit if possible, as well as rootstocks and foliage.

* Spike solitary and simple, terminal, androgynous, male at top : stigmas 3.

Bracts scale-like, colored.

Perigynium spindle-shaped, reflexed : stigmas rarely 2. 1. C. PYRENAICA.

Perigynium obovoid, hairy at top : scales very broad : leaves filiform. 2. C. FILIFOLIA.

Perigynium a large much inflated sac. 3. C. BREWERI.

Bracts foliaceous, green.

Spike linear : perigynium triangular-ellipsoidal, closely applied to the rhachis, 1-nerved on two of its sides. 4. C. GEYERI.

* * Spike composed of sessile androgynous or rarely diœcious spikelets : stigmas 2.

Spikes diœcious, or the spikelets androgynous with the male and female flowers irregularly situated.

Perigynium narrowly lanceolate, spongy at base. 5. C. BROMOIDES.

Wide creeping : perigynium ovate-lanceolate, abruptly long-beaked. 6. C. SICCATA.

Extensively creeping : spikelets numerous : perigynium ovate, less tapering, the margins not united to the top. 7. C. DISTICHA.

Some of the spikes occasionally wholly female : perigynium ovate, stipitate, concealed by the scale, at length nearly black. 8. C. MARCIDA.

Nearly diœcious : perigynium coriaceous, chestnut-colored, shining, ovate with short minute beak, gibbous on the outer sides. 9. C. GAYANA.

Diœcious : spikelets crowded, large : bracts and scales largo. 10. C. DOUGLASII.

Spikelets androgynous, aggregated at the top of the stem.

Spikelets male at top.

Spikelets ovate, 8 to 10, light chestnut : perigynium ovate, sharply bidentate. 11. C. HOODII.

Spike capitate, roundish, of many crowded dark chestnut spikelets : perigynium ovate or elliptical, bidentate, stipitate. 12. C. FŒTIDA.

Spike oblong or cylindrical, of 4 to 10 spherical spikelets, shorter than the awned bracts. 13. C. MURICATA.

Spike elongated, of very many small spikelets or clusters of spikelets, shorter than the setaceous bracts. 14. C. GLOMERATA.

Spikelets ferruginous, oblong, crowded, sessile : perigynium ovate or deltoid, coriaceous, spongy at base. 15. C. PANICULATA.

Spikelets male at bottom.

Spikelets usually 3 : perigynium oval and gradually or obovate and abruptly short-beaked, nerved, coriaceous; margins obtuse or slightly serrate above. 16. C. LAGOPINA.

Leaves and often the filiform bracts far exceeding the stem : spikelets 3 to 6, lance-ovate : perigynium membranous, gradually beaked, sharply margined, serrate, nerveless. 17. C. PHYLLOMANICA.

Spikelets 3 to 6, dark brown : perigynium attenuate-lanceolate; margins not winged, smooth or rarely scabrous. 18. C. BONPLANDII.

Spikelets 6 to 12 or more, crowded in a round or oblong ferruginous head : perigynium ovate or elliptical, beaked, serrate on the winged margins, divergent. 19. C. FESTIVA.

Spike oblong, tawny, of 4 to 6 small contiguous spikelets : perigynium ovate, abruptly short-beaked, very convex outside, strongly nerved, serrate on the narrow wings, spreading. 20. C. SUBFUSCA.

Spike globose, straw-colored, of 5 to 20 spikelets: bracts expanded at base, longer than the stem: perigynium ovate-lanceolate, spongy at base. 21. C. ATHROSTACHYA.

Spike variegated, chestnut and green, subglobose, of 3 to 8 rather large spikelets: perigynium broadly ovate or orbicular, abruptly attenuate to a sharp minutely bidentate beak, broadly winged to the base, exceeding the scale. 22. C. STRAMINEA.

Spikelets distinct.

Spikelets male at top.

Spike linear-oblong, of 4 to 7 contiguous sessile spikelets: perigynium obovate, attenuate to the base and to the obliquely cut entire beak, nerveless, about as long as the broadly ovate mucronate scale. 23. C. VALLICOLA.

Spikelets 2 to 6, remote, 2–6-flowered: perigynium oblong, biconvex, abruptly minutely beaked, closely striate-nerved, coriaceous, longer than the scale. 24. C. TENELLA.

Spikelets male at bottom.

Spikelets 3 to 10, ellipsoidal, remote: perigynium ovate, abruptly short-beaked, many-nerved, spongy at base. 25. C. CANESCENS.

Spikelets 3 to 10: perigynium lanceolate, acuminate, rostrate, spongy at base, exceeding the 1–3-nerved scale. 26. C. DEWEYANA.

Spikelets 4 to 8, polygamous: perigynium ovate from a cordate sharp-margined base, nerved, sharply toothed, divergent, equalling the scale. 27. C. STERILIS.

Spikelets 3 or 4, round: perigynium ovate-lanceolate from a round or ovate spongy base, rostrate, squarrose spreading, twice as long as the scale. 28. C. ECHINATA.

Spikelets pale, 8 to 10, ellipsoidal, 8 to 14 lines long: perigynium lanceolate, acuminate, rostrate, twice as long as the scale. 29. C. ARIDA.

Spike fulvous, ovoid or oblong, of 8 to 12 crowded or contiguous spikelets: perigynium narrowly lanceolate, attenuate, rostrate, longer than the scale. 30. C. SCOPARIA.

Spikelets numerous, pale, ellipsoidal, obovoid, crowded or contiguous: perigynium elliptical, gradually beaked, longer than the scale. 31. C. LAGOPODIOIDES.

Spike oblong, of 7 to 10 or more ellipsoidal contiguous spikelets: perigynium ovate, winged to the base, exceeding the scale. 32. C. CRISTATA.

Spike oblong, of 4 to 10 round or obovoid spikelets, the lower subremote: perigynium ovate or orbicular, strongly nerved, equalling the scale: nutlet orbicular, large. 33. C. ADUSTA.

* * * Uppermost spikelet male at base; the rest female: stigmas 3.

Perigynium granular, obscurely nerved, the orifice entire or emarginate, shorter than the scale. 34. C. BUXBAUMII.

Perigynium not granular, nerved, bidentate: scales shorter. 35. C. BIFIDA.

Perigynium compressed above, triangular below, nerveless. 36. C. ATRATA.

Perigynium nerveless, except 2 intramarginal nerves and 2 short nerves diverging from the base of the beak. 37. C. HETERONEURA.

* * * * Spikelets unisexual; the upper male, mostly single; the rest female or sparingly androgynous.

Stigmas 2.

Perigynium beakless, globose or pear-shaped, coriaceous, strongly nerved. 38. C. AUREA.

Perigynium short-beaked.

Very slender: spikelets rather loose: perigynium ovate, tapering to an entire truncate orifice, not winged, obscurely nerved: nutlet abruptly prolonged into the curved cylindrical style. 39. C. KELLOGGII.

Perigynium round-obovate or ovate, nerveless, abruptly beaked, orifice entire or emarginate: sheaths entire: stigmas 2 or 3. 40. C. VULGARIS.

Perigynium oval, rostellate with entire orifice, stipitate, papillose, strongly nerved, deciduous: nutlet globose. 41. C. DECIDUA.

Male spikelet sometimes female below: perigynium elliptical, compressed and empty above, with the beak entire, plano-convex below, delicately nerved, resinously dotted, very deciduous: sheaths fibrous-reticulate. 42. C. NUDATA.

Male spikelets 1 to 4, the female 2 to 5: perigynium elliptical or obovate, stipitate, nerveless, resinously dotted, the orifice

entire: lower bracts exceeding the stem: sheaths not fibrous-reticulate. 43. C. AQUATILIS.

Male spikelets 1 to 3, the female 1 to 4, commonly male at top: bracts seldom exceeding the stem: lower sheaths conspicuously fibrous-reticulate: perigynium nerveless or 1–4-nerved, broader than the scale. 44. C. ANGUSTATA.

Lower sheaths scabrous, fibrous-reticulate: male spikelets 1 or 2; female 2: bracts shorter than the stem: perigynium ovate, toothed on the margins: upper scales mucronate. 45. C. SENTA.

Male spikelets 1 or 2, often female at top: perigynium pale, broadly oval, ending in a short cylindrical entire beak, biconvex, stipitate, nerved: bracts longer than the stem: scales 1–3-nerved: sheaths entire. 46. C. LENTICULARIS.

Stem 2½ to 5 inches high: bracts exceeding the stem, sheathed: perigynium oval, nerved, the orifice entire: scales clasping, broadly oval, obtuse or the female awned, 3-nerved. 47. C. SALINA.

Stem 1 to 4½ feet high, stout: lower sheaths fibrous-reticulate: male spikelets 1 to 4; female 3 to 5, 1 to 4 inches long: perigynium purple, orbicular-obovoid, turgid, stipitate, coriaceous, nerveless: bracts far exceeding the stem. 48. C. SITCHENSIS.

Male spikelets 1 to 4; female 3 or 4: perigynium oval or obovate, abruptly ending in a bidentate beak with serrate teeth, biconvex above, strongly nerved, resinously dotted: scales acute or cuspidate: bracts about the length of the stem. 49. C. JAMESII.

Male spikelets 1 or 2; female 3 or 4, remote: perigynium oval or obovate, lenticular-compressed, sparingly toothed on the upper margins, nearly entire or bidentate with serrate teeth, punctate, more or less nerved: scales ciliate, acute or awned: bracts far exceeding the stem. 50. C. LACINIATA.

Spikes long-cylindrical; male 1 or 2; female 4 to 8: perigynium ovate, rostellate, emarginate, nerved: scales purple, broadly ovate, emarginate, 3-nerved, cuspidate: bracts much longer than the stem. 51. C. PRESCOTTIANA.

Stigmas 3.

Perigynium beakless or short-beaked, the orifice entire or emarginate or bidentate.

Perigynium smooth.

Stem obtusely angled: spikes oblong; male 1; female 1 or 2, rarely 3: perigynium ovoid, obtusely angled, ending in a short straight point, nerved, granular. 52. C. LIVIDA.

Stem sharply angled: leaves and bracts broad: spikes cylindrical, 4 or 5; male 1; female loosely flowered: perigynium ellipsoidal, many-nerved, acute at each end, erect or bent at the apex, the orifice hyaline and entire. 53. C. LAXIFLORA.

Spikes 3 to 6, ellipsoidal or club-shaped; male 1, rarely 2; the lower female peduncled, pendulous: perigynium oval or ovate, abruptly rostellate with entire or bidentate beak, obscurely nerved. 54. C. PODOCARPA.

Spikes 3 to 6, oblong or obovoid; male 1: perigynium yellowish, obovoid, ventricose, abruptly rostellate with purple emarginate beak, nerved, divergent. 55. C. RAYNOLDSII.

Spikes 3 or 4, oblong or club-shaped: perigynium elliptical, rostrate, bidentate, the spreading teeth serrate-toothed. 56. C. SERRATODENS.

Perigynium pubescent.

Spikes 2 to 4; male 1: perigynium obovoid, abruptly rostellate, the orifice entire, nerveless: bracts purple, leafless, subulate: scales ciliate. 57. C. RICHARDSONI.

Spikes 4 to 6; the male 1; the lower female subradical: perigynium globose, tapering to the base, coriaceous, abruptly rostrate, nerved, bidentate: scales 1–3-nerved. 58. C. GLOBOSA.

Spikes 3 or 4, loosely few-flowered; male 1; lower female subradical: perigynium coriaceous, hispid, triangular-subglobose, tapering to the obscurely striate base, the beak straight or bent, bidentate: scales clasping, 1–3-nerved. 59. C. BREVIPES.

Hairy: spikes 2 to 4; male 1, often female at top; female cylindrical, loosely flowered, the lower remote on long erect peduncles: perigynium triangular-ellipsoidal, acute at base, abruptly rostrate, beak bidentate. 60. C. HIRTISSIMA.

Spikes 3 to 5; male 1: perigynium covered with long white hairs, sharply triangular-ellipsoidal, acute at each end, 1–4-nerved on the sides, the beak very short-bidentate. 61. C. TRIQUETRA.

Beak of perigynium more or less elongated.

Beak emarginate or obliquely truncate.

Spikes cylindrical, 2 to 4; the male 1 to 3; female 1 or 2: perigynium triangular-ellipsoidal, turgid, nerved, densely granular, beak obliquely cut with conspicuously hyaline orifice. 62. C. POLYMORPHA.

Spikes 5 to 7, cylindrical; the male single: perigynium ellipsoidal, turgid, divergent, nerveless, glabrous, abruptly rostellate, the oblique orifice hyaline: scales 3-nerved. 63. C. AMPLIFOLIA.

Spikes 5 to 11, oblong-cylindrical; the male 2 or 3: perigynium inflated, glabrous, ovoid or lanceolate, rostellate, obsoletely nerved, the orifice entire and hyaline. 64. C. CHEROKEENSIS.

Pubescent: spikes 3 to 5, oblong or cylindrical; the male 1 or 2: perigynium smooth, ellipsoidal, sharply angled, rostrate, nerved, the orifice emarginate: scales 3-nerved, ciliate. 65. C. WHITNEYI.

Pubescent throughout: spikes 5 to 8, cylindrical; the male 1: perigynium triangular-obovoid, abruptly rostrate, the oblique orifice entire: scales 1–3-nerved. 66. C. SARTWELLIANA.

Beak bidentate.

Perigynium smooth.

Spikes 3 to 5, cylindrical, slender; the male 1: perigynium ellipsoidal, short-beaked, acute at base, nerved: margins of the sharp teeth ciliate. 67. C. CINNAMOMEA.

Spikes 3 or 4, linear, loosely-flowered: perigynium ellipsoidal, acute at base, nerved, short-beaked, the obtuse white teeth ciliate. 68. C. MENDOCINENSIS.

Spikes 4 to 6, oblong; the male 1: perigynium oblong or ovate, obsoletely nerved, the beak serrate: scales 1–3-nerved. 69. C. LUZULINA.

Spikes cylindrical or club-shaped; the male 1 to 3: bracts shorter than the peduncle, their sheaths enlarging upwards: perigynium membranous, compressed-triangular, slenderly nerved: stem tall: leaves 2 to 4 lines broad. 70. C. LUZULÆFOLIA.

Slender: spikes 3 to 6; male 1 or 2, cylindrical; female oblong: perigynium ellipsoidal, nerved, the teeth hyaline: leaves 1 line broad. 71. C. FULVA.

Perigynium hirsute.

Spikes 3 to 6; male 1 to 4: perigynium coriaceous, hispid, ovoid, obtusely angled, abruptly short-beaked with divergent teeth, nerved. 72. C. FILIFORMIS.

Spikes 4 or 5; male 1: perigynium ellipsoidal, glabrous at base, hirsute at top, slightly nerved at base. 73. C. GYNODYNAMA.

Perigynium long-beaked, large, inflated (except n. 78), bicuspidate.

Male spikes 3 to 5; female 2 to 4: perigynium ovoid or lanceolate, strongly nerved, the teeth long and slender. 74. C. TRICHOCARPA.

Male spikes 2 to 4; female 1 to 3, remote: perigynium globular-ovoid, inflated, 8–10-nerved. 75. C. MONILE.

Male spikes 2 or 3; female 2 to 4: perigynium ovoid or conical, ascending, many-nerved. 76. C. VESICARIA.

Male spikes 2 to 5; female 2 to 6: perigynium ellipsoidal or globose-ovoid, often squarrose: scales awned: stem spongy at base: leaves conspicuously nodose. 77. C. UTRICULATA.

Male spike 1; female 3 to 5, drooping: perigynium subturgid, lanceolate, stipitate, unequally 3-angled, attenuate to a long slender bicuspidate beak, the subulate teeth divergent: scales hispidly awned. 78. C. PSEUDOCYPERUS.

§ 1. *Spike solitary, terminal, androgynous, staminate at top: stigmas* 3.

* *Bracts colored, scale-like.*

1. **C. Pyrenaica,** Wahl. Cespitose, the filiform stems 1½ to 7 inches high, very leafy at base: leaves ½ to 1 line broad, flat or often conduplicate: spike dark brown or purple, ellipsoidal, densely flowered, 5 to 8 lines long by 2 to 4 lines thick; scales membranous, deciduous, in the male flowers linear-oblong, acutish, the female darker, ovate-lanceolate or oblong-lanceolate, acute or obtuse, the lowest often

cuspidate or subfoliaceous: perigynium membranous, lanceolate or spindle-shaped, gradually attenuate to an acute obliquely cut subentire hyaline-margined orifice, compressed triangular or biconvex, nerveless or rarely 2–3-nerved on the outer side at base, long-stipitate, shining, reflexed at maturity, rather longer than the scale: style enlarged at base; stigmas rarely 2: nutlet oblong, lenticular or unequally 3-sided, stipitate. — Meyer, Cyp. Nov. 212, t. 7; Reichenb. Icon. Fl. Germ. viii, t. 198; Boott, Ill. Car. iv. 148, t. 475, 476.

On Mount Shasta, at 8,400 feet altitude (*Brewer*, n. 1379); in the mountains from Colorado and Northern Utah to Alaska, as also in Asia, Europe and New Zealand.

2. **C. filifolia,** Nutt. Cespitose: stems 6 to 10 inches high, obtusely angled, leafy at base and there enclosed with bundles of sterile leaves in long chestnut-colored sheaths that break up into reticulate fibres: leaves rigid, filiform, involute, at first equalling and finally shorter than the stem: spikes narrowly oblong, ferruginous fading to chestnut, naked: perigynium triangular-obovoid, pale below, ferruginous and sparsely hairy above, nerveless or obscurely nerved at base, rostellate, with entire white-hyaline orifice, nearly equalling the suborbicular clasping hyaline-margined scale: stigmas elongated: nutlet triangular-obovoid, tipped with the enlarged base of the style, chestnut-colored, longer than the linear white-tipped racheola. — Boott, l. c., i. 13, t. 37.

In the Sierra Nevada, at Soda Springs on the Tuolumne River, at 8,700 feet altitude, and in the Mono and Ebbett Passes, at 11,000 feet (*Brewer*, n. 1697, 1733, 2029), in the Calaveras Grove (*Bolander*, n. 2318) and in Sierra County (*Lemmon*); also on the dry plains and mountains from Colorado to the Saskatchewan and Upper Columbia.

3. **C. Breweri,** Boott. Rootstock creeping, stoloniferous: stem 5 to 18 inches high, obtusely angled, smooth, leafy at base: leaves rigid, filiform, the cauline shorter than the stem: spike of a dark fulvous or chestnut color, oval or ovate, 6 to 12 lines long by 6 lines thick, naked; male flowers few: perigynium oval, much inflated and very thin, delicately nerved, with a very short obliquely cut entire beak, whitish at the orifice, longer and broader than the lanceolate obtuse hyaline-margined scale: nutlet oblong-obovoid, triangular, shorter than the filiform racheola. — Ill. Car. iv. 142, t. 455.

In the Sierra Nevada, in dry soil, from Mount Shasta, at 9,000 feet altitude (*Brewer*, n. 1391, 1392; *Hooker & Gray*), and Lassen's Peak at 10,000 feet (*Brewer*, n. 2176), to Mount Dana and Mount Brewer (*Brewer*, n. 1863, 2839); Oregon, *Hall*, n. 570.

C. POLYTRICHOIDES, Muhl., growing on the Rocky Mountains and from Cumberland House to Florida, will probably be found in California. Stem filiform, 12 to 18 inches high: spike green, oblong-linear, few-flowered: perigynium oblong, compressed-triangular, obtuse with entire orifice, appressed, striate-nerved, much longer than the white ovate acute or cuspidate scale: nutlet triangular, oblong-obovoid: stigmas 3 or 2.

* * *Bracts and lower scales green and leaf-like.*

4. **C. Geyeri,** Boott. Rootstock creeping: stem slender, stiff, ½ to 2 feet high, leafy at base: leaves rigid, ½ to 1 line broad, carinate, scabrous on the margin and keel: spikes pale green, linear, 10 to 15 lines long, the male portion 5 to 10 lines long; female flowers 1 to 6, alternate, appressed to the rhachis; scales whitish becoming ferruginous, green in the middle, ciliate, in the male flowers oblong and obtuse, the female clasping and cuspidate, the lower foliaceous and equalling the stem: perigynium triangular-ellipsoidal, tapering to the base, with a very short entire beak and hyaline ciliate orifice, membranous, smooth, 1-nerved on the middle of two sides, shorter than the scale: style enlarged at base, deciduous: nutlet conformed to and closely invested by the perigynium, chestnut-colored. — Linn. Trans. xx. 118, and Ill. Car. i. 42, t. 105; Kunze, Car. 186, t. 47.

In the Coast Ranges between Santa Rosa and Ukiah (*Bolander*, n. 3906), and frequent in the Sierra Nevada from the Yosemite Valley (*Torrey*, n. 544) to Plumas County (*Mrs. Ames*); also in the Rocky Mountains from Colorado to Northern Idaho (*Geyer*), and in the Wahsatch near Salt Lake City.

§ 2. *Spikes composed of sessile androgynous spikelets, rarely dioecious: stigmas* 2.

* *Spikes dioecious, or the spikelets androgynous with the male and female flowers irregularly situated.*

5. **C. bromoides,** Schk. Stems densely tufted, 1 to 2½ feet high, very slender, often decumbent, sharply angled, scabrous: leaves flat, grass-like, 1 to 1½ lines broad, shorter than the stems: bracts scale-like, the lowest clasping, setaceous, sometimes longer than their spikelets: spikes pale, becoming ferruginous, linear or narrowly oblong, an inch or two long, of from 4 to 8 ellipsoidal loosely-flowered spikelets, contiguous or the lowest somewhat remote, male or female or androgynous (male at top or at bottom), 3 to 7 lines long by 2 lines thick, the terminal one the largest; scales membranous, hyaline, white with green midnerves, becoming ferruginous, ovate-lanceolate, acute or cuspidate: perigynium membranous, linear-lanceolate, attenuate to a long obliquely cut entire or bidentate beak, spongy at base, plano-convex, scabrous on the sharp margins, nerved, with a long fissure on the outer side, longer than and as broad as the scale: nutlet closely invested by the perigynium, oblong-ovate, obtuse, narrowed at base, lenticular, chestnut-colored, shining: style enlarged at base, deciduous. — Car. fig. 176; Boott, l. c. ii. 82, t. 227.

In the Calaveras Grove (*Bolander*, n. 2315); in the Rocky Mountains of Colorado, and eastward from British America to Florida.

6. **C. siccata,** Dewey. Rootstock creeping extensively, clothed with short lanceolate scales and bearing slender sharply angled stems ½ to 2 inches apart and ½ to 2 feet high: leaves rather rigid, ½ to 2 lines broad: bracts scale-like, the lowest roughly cuspidate, mostly shorter than the spikelets: spikes oblong, ¾ to 2 inches long by 2 to 4 lines thick, ferruginous, of from 4 to 12 ovoid alternate simple spikelets 2 to 8 lines long by 1 to 4 thick, crowded or the lower subremote, the terminal female or female at base and the intermediate ones male, or the male and female flowers variously mingled; scales membranous, ovate-lanceolate, acute, ferruginous, with broad hyaline margins: perigynium membranous, oval or ovate, acuminate to a long sharply bidentate beak, fissured on the outer side, unequally serrate on the winged margins, plano-convex, nerved, about equalling the scale: nutlet oblong, plano-convex, dark chestnut, shining. — Am. Journ. Sci. x. 278; Boott, l. c., i. 19, t. 52, 146. *C. pallida,* Meyer, Cyp. Nov. 215, t. 8.

In dry soil, in the Sacramento Valley (*Hartweg*, n. 2023) and near Mark West Creek (*Bigelow*), and in the Sierra Nevada northward to the Columbia River, in the Rocky Mountains from British America to Colorado, and in the northern Atlantic States; also in northeastern Asia.

7. **C. disticha,** Hudson. Rootstock creeping, clothed with lanceolate brown scales: stems 1 to 3½ feet high, scabrous above on the sharp angles: leaves a line or two broad, mostly shorter than the stem: bracts cuspidate from a lanceolate base, the lower prolonged beyond their spikelets, the lowest sometimes equalling the stem: spike ferruginous, 1 to 3 inches long by 3 to 8 lines thick, oblong, lanceolate or linear, obtuse, of numerous ellipsoidal or ovoid or subspherical spikelets, contiguous or the lower distinct; arrangement of the flowers very variable, the upper and middle spikelets being frequently almost wholly staminate and the lower principally or entirely female, or rarely all entirely female or male at top; scales ferruginous with hyaline margins, membranous, ovate, acute: perigynium ovate or oval, gradually tapering to a rather short obliquely cut entire (at length bidenticulate) beak, long-fissured on the outer side, stipitate, plano-convex, nerved, punctate, serrate above on the sharp or narrowly winged margins, about equalling the scale: nutlet loosely invested by the perigynium, ovate or orbicular, lenticular, chestnut-colored, shining. — Boott, Ill. iii. 125, t. 410. *C. intermedia,* Good.; Reichenb. l. c., t. 210. *C. Sartwellii,* Dewey, Am. Journ. Sci. xliii. 90.

Collected by *Bolander*, but locality uncertain, and near Carson City (*Stretch*, *Watson*); from the Saskatchewan to the northern Atlantic States, and in the Rocky Mountains southward to Colorado and Utah; also through Europe and northern Asia.

8. **C. marcida,** Boott. Stem 1 to 2½ feet high, slender, scabrous: leaves a line broad, shorter than the stem: spike 8 to 15 lines long, 3 to 5 lines thick, sometimes nearly diœcious, of a dull brown color, composed of many ovate crowded or contiguous closely imbricated spikelets 2 or 3 lines long and a line thick, the upper simple, the lower compound: bracts clasping, scale-like, setaceously pointed, the lowest exceeding its spikelet: perigynium nearly black at maturity, orbicular with a short, or ovate with a longer bidentate beak, stipitate, plano-convex or the sharp margins incurved, nerved, serrate above, equalling the ovate acute or cuspidate hyaline-margined scale: nutlet ferruginous, oval, lenticular, produced at base. — Hook. Fl. Bor.-Am. ii. 212, t. 213, and Ill. i. 16, t. 45.

From Oregon and the Saskatchewan to Southern California, Utah and New Mexico; on the Lower Sacramento (*Pickering*); Santa Clara marshes (*Peckham*); Fort Tejon (*Horn*); Sierra County, *Lemmon*, etc.

9. **C. Gayana,** Desv. Rootstock creeping: stem 1 or 2 feet high, scabrous: leaves a line or two broad, shorter than the stem: spike dark chestnut, 8 to 10 lines long and 4 to 7 thick, oblong or ovoid, capitate, diœcious or very nearly so, naked or with 1 or 2 setaceous bracts shorter than the stem, of numerous crowded spikelets 2 to 4 lines long, the lower compound; scales membranous, chestnut-colored with hyaline margins, ovate, acuminate, carinate, cuspidate: perigynium chestnut-colored and shining, thick and spongy, broadly ovate or triangular in outline, very convex or gibbous below on the outer sides, flat on the inner, long-fissured on the outside, few-nerved at the somewhat cordate stipitate base, serrate above on the slightly winged margins, ending in a very short minute conical beak with a nearly entire whitish orifice, shorter than the scale: nutlet dark chestnut, orbicular, produced at base. — Gay, Fl. Chil. vi. 205, t. 73, fig. 3; Boott, Ill. iii. 126, t. 411.

Sonora Pass (*Brewer*); in the Rocky Mountains of Colorado and New Mexico, also in Chili. Boeckeler (Linnæa, xxxix. 54) refers the species to *C. divisa*, Huds., which is found in Europe, Asia and Africa.

10. **C. Douglasii,** Boott. Rootstock creeping: stem about a foot high, obtusely angled, smooth: leaves 1 or 2 lines broad, tapering to an extremely slender triangular summit: bracts scale-like, clasping, cuspidate or the lowest prolonged beyond the stem: spikes diœcious or nearly so, oblong, pale or chestnut-colored or ferruginous, an inch or two long and 6 to 9 lines thick, of many ellipsoidal or ovoid crowded spikelets, the upper simple, the lower compound and sometimes branching, often half an inch long: perigynium ovate or lanceolate-ovate, acuminate to a slender obliquely cut entire (at length bidentate) beak, stipitate, nerved, very convex on the outer side, the obtuse margins incurved, serrate above, shorter than the ample membranous oblong or lanceolate acute or cuspidate hyaline-margined scale: nutlet chestnut-colored, suborbicular: stigmas very long. — Hook. Fl. Bor.-Am. ii. 213, t. 214. *C. Nuttallii*, Dewey, l. c. lxiii. 92, t. 2, fig. 97.

Var. **brunnea,** Olney. Taller, 10 to 22 inches high: leaves equalling or longer than the stem, which very rarely bears a second spike on a long (10 inches) filiform subradical peduncle: lower bracts long-awned: spikelets fewer, the lowest distinct; scales chestnut-brown. — Bot. King Exp. 360.

Frequent from Washington Territory and the Rocky Mountains of British America to New Mexico and Northern Mexico; in the Yosemite Valley (*Bolander*, n. 6199), and in Mono Valley, *Brewer*, n. 1813. The variety near Auburn and Sacramento City (*Bolander*, n. 4503, 4549, 4550), and in Washoe Valley, Nevada, *Stretch*, *Watson*.

* * *Spikelets androgynous, aggregated at the top of the stem.*

\+ *Spikelets male at the top.*

11. **C. Hoodii,** Boott. Stems very slender, sharply angled, scabrous: leaves 1 to 1½ lines broad, the upper the longest, equalling or exceeding the stem: bracts scale-like, ovate or the lowest setaceous, shorter than the stem: spike ferruginous, of

9 or 10 or more ovate spikelets closely aggregated in an ellipsoidal or ovate head 8 to 10 lines long and 5 or 6 thick; scales membranous, ferruginous with green midnerves and hyaline margins, ovate, acute or mucronate, striate: perigynium ovate, beaked, sharply bidentate, fissured on the outer side, membranous, smooth, nerved, serrate on the sharp margins, longer than and as broad as the scale: nutlet chestnut-colored, orbicular, produced at base, lenticular: style enlarged at base. — Hook. Fl. Bor.-Am. ii. 211, t. 211, and Ill. i. 17, t. 46.

In the Sierra Nevada from the Yosemite Valley (*Bolander*, n. 6215, 6218) to Oregon; at Soda Springs on the Tuolumne at 9,000 feet altitude (*Brewer*, n. 1702, 1772) and in Sierra Valley (*Lemmon*); found also in Kamtschatka.

12. **C. fœtida,** All. Rootstock stout, creeping: stem 3 to 18 inches high, sharply angled, rough above, leafy toward the base: leaves a line or two broad, spreading, tapering to a very slender triangular summit: bracts scale-like, cuspidate, shorter than the stem: spike dark brown, ovoid or subglobose, 5 to 7 lines long and 4 to 6 thick, of many densely crowded spikelets: perigynium membranous, elliptical or ovate, attenuate to a bidentate beak, plano-convex, stipitate, rough above on the sharp margins, slenderly nerved at base, longer than the ovate-lanceolate acute or mucronate ferruginous pale-margined scale: nutlet oblong or obovate, lenticular, tipped with the enlarged base of the style, nearly black at maturity. — Schkuhr, Car. fig. 96; Reichenb. l. c., t. 199.

In the Sierra Nevada, at Ebbett's Pass near snow (*Brewer*, n. 2066) and in the Calaveras Grove (*Bolander*, n. 2304), and in the Cuiamaca Mountains (*Palmer*, n. 389); in the mountains of Colorado, Utah and Wyoming, and in the Alps and Pyrenees of Europe.

13. **C. muricata,** Linn., var. **gracilis,** Boott. Rootstock creeping, clothed with imbricated strongly nerved purple scales: stem very slender, $\frac{3}{4}$ to 2 feet high, sharply angled, scabrous: leaves shorter than the stem, a line broad, tapering to a very slender setaceous summit: bracts ovate, awned, commonly exceeding the spikelets, the lowest setaceous and often an inch or two long: spike chestnut-colored, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, oblong or cylindrical, of from 4 to 10 ovate crowded or approximate spikelets; male flowers few; scales ovate or lanceolate, very acute or mucronate, chestnut-colored with green midnerve and hyaline margins: perigynium oval, acute at base, rather abruptly acuminate to a sharply bidentate beak, convex on the outer side, serrate above on the sharp incurved margins, nerved or nerveless, shorter than the scale: nutlet oval or obovate, slightly narrowed to the base, lenticular. — Ill. iv. 193. *C. Hookeriana*, Dewey, l. c. xxix. 248; Boott in Hook. l. c., t. 212.

Near the coast, from about San Francisco Bay (*Bigelow*, *Bolander*) to Mendocino County (Fort Bragg, *Bolander*, n. 4765); also in the Rocky Mountains from British America to New Mexico, Utah and Northern Nevada. The typical form is found in the northern Atlantic States, as well as in the Rocky Mountains, Northern Nevada and Oregon, and is also European.

14. **C. glomerata,** Thunb. Rootstock creeping: stem 10 to 30 inches high, firm, slightly scabrous above: leaves 1 to $2\frac{1}{2}$ lines broad, shorter than the stem: bracts setaceous, exceeding the spikelets, the lowest sometimes exceeding the stem: spike ferruginous, 6 to 20 lines long and 3 to 8 thick, ovate, oblong, or cylindrical, of numerous small roundish crowded spikelets or clusters of spikelets, the lower often distinct; scales ovate, acute, cuspidate: perigynium divergent, membranous, ovate, rostrate and bidentate, plano-convex, nerved, serrate above on the somewhat winged margins, longer and broader than the scale: nutlet suborbicular, lenticular, narrowed toward the base: style bulbous at base. — Boott, Ill. ii. 81, t. 222. *C. Bronyniartii*, Kunth; Gay, Fl. Chil. vi. 208, t. 73, fig. 10; Boott, Ill. iv. 124, t. 401 – 403.

From about San Francisco Bay (*Bigelow*, *Bolander*) to Mendocino City (*Bolander*) and at Mariposa (*Thurber*); also in Mexico, Chili, and at the Cape of Good Hope.

15. **C. paniculata,** Linn. Densely cespitose: stem 3 to 5 feet high, sharply angled with flat sides, very scabrous: leaves 3 or 4 lines broad, flat, serrate-scabrous

on the margins, the upper often exceeding the stem: bracts cuspidate or setaceous: spike pale or ferruginous, nearly linear, simple with oblong sessile spikelets, or compound and branching, 4½ inches long and an inch broad, the branches 1 to 1½ inches long, or elongated to a foot in length with branches 3 inches long; scales membranous, ferruginous with broad hyaline margins, ovate, acutish or mucronulate: perigynium ferruginous, shining, coriaceous with spongy base, ovate or deltoid, attenuate to an obliquely cut bidentate beak with herbaceous serrate wings and hyaline orifice, plano-convex, faintly many-nerved on both sides, longer than the scale: nutlet ovate, produced at base, biconvex, punctate: style bulbous at base. — Fl. Dan. t. 1116; Reichenb. l. c., t. 223.

In salt marshes near San Francisco (*Bolander*, n. 1568 in part), a variety with contracted spikes. The species belongs to Europe and western Asia.

C. STIPATA, Muhl., native from Arctic America to Florida and in the Rocky Mountains to Colorado and Oregon, is likely to be found in California. Stem 1 to 3 feet high, very sharply angled and scabrous: inner face of the sheaths commonly transversely corrugate: spike oblong or lanceolate, of many aggregated spikelets, the lower compound: perigynium stipitate, lanceolate, tapering from a spongy truncate base to a long slender bidentate sharply margined serrate beak, diverging, many-nerved, much longer than the lanceolate acute or cuspidate scale: nutlet chestnut-colored, ovate, produced at base: style enlarged at base.

+ + *Spikelets male at bottom.*

16. **C. lagopina,** Wahl. Cespitose, with short stolons: stem 4 to 12 inches high, often obtusely angled, scabrous only at the summit: leaves flat, ½ to 1 line broad, nearly equalling the stem: bracts scale-like, clasping, cuspidate, the lowest rarely exceeding its spikelet: spike reddish ferruginous, ellipsoidal or oblong, 6 to 12 lines long and 3 to 6 thick, of from 3 to 6 (usually 3) crowded or contiguous ellipsoidal or subglobose spikelets, the terminal one largest, the lower sometimes wholly female, and the lowest subremote; scales fuscous with broad hyaline margins and green midnerve, ovate, obtuse: perigynium coriaceous, oval or elliptical, with acute base and slender beak, or roundish obovate and abruptly rostellate, with entire hyaline orifice, not winged, fissured on the outer side, smooth or serrate on the upper margins, plano-convex, many-nerved, longer than the scale: nutlet orbicular or ovate, plano-convex, punctate. — Reichenb. l. c., t. 204.

In the Sierra Nevada, at a small lake near Ebbett's Pass (*Brewer*, n. 2063); Uinta Mountains (*Watson*); Arctic America and Greenland, and in the Rocky Mountains of British America; also in Europe.

17. **C. phyllomanica.** Stem 6 to 18 inches high, smooth: leaves rigid, a line or two broad, attenuate to a subulate triangular summit, much exceeding the stem: lowest bract filiform, often far exceeding the stem, the others scale-like and shorter than their spikelets; auricles minute, connate, chestnut-colored: spike chestnut-colored, oblong, ¾ of an inch long, of from 3 to 6 spikelets, contiguous or the upper ones crowded, the uppermost the largest (3 or 4 lines long) and linear-club-shaped, the others ellipsoidal; scales broadly ovate or roundish, obtuse, chestnut-colored with green midnerve and hyaline margins: perigynium (immature) lance-ovate, obtuse at base, gradually tapering to an obliquely cut nearly entire beak, the orifice and long fissure on the outer side reddish brown, serrate above on the acute wingless margins, not nerved, a little longer than the scales: nutlet orbicular.

In sphagnous swamps near Mendocino City, *Bolander*, n. 4746. Differing from *C. lagopina*, Wahl., in the much longer leaves and bracts, and in the more roughly serrate and sharper margins of the perigynium, the orifice of which is not hyaline. The lateral spikelets are always androgynous and not, as in *C. lagopina*, often entirely female.

18. **C. Bonplandii,** Kunth, var. **angustifolia,** Boott. Stem filiform, about a foot high, scabrous: leaves ½ to 1 line broad, grass-like, shorter than the stem: bracts scale-like, clasping, the lowest rarely setaceously pointed, shorter than the stem: spike dark brown, ellipsoidal or ovate, 3 or 4 lines long and 2 or 3 broad, of from 3 to 6 ovoid or roundish crowded spikelets; scales membranous, broadly oval.

acutish: perigynium spreading, ovate or lanceolate, attenuate to a dark-colored obliquely cut entire beak fissured on the outer side and not winged, smooth on the margins, nerved, equalling or longer than the scale: nutlet chestnut-colored, oblong, produced at base, lenticular. — Ill. iii. 115. *C. Bonplandii*, var. *minor*, Olney, Bot. King Exp. 365.

In the Sierra Nevada, from the Yosemite Valley and Mono Trail (*Bolander*, n. 4903, 6207) to Donner Pass (*Torrey*, n. 550); also in the mountains of Colorado and Utah. The original species is found in the Andes of tropical South America. In Bolander's specimens from the Yosemite Valley the spikelets are mostly female and have rarely a few male flowers at top. Kunth places the species in an androgynous section with spikelets male at top, but describes it as furnished "spicis mere femineis."

19. **C. festiva,** Dewey. Cespitose: stem ½ to 2 feet high, sharply angled: leaves 3 to 5, the upper the longest, commonly shorter than the stem, 2 or 2½ lines broad: spike dark-ferruginous, 6 to 12 lines long and 3 to 12 thick, of from 6 to 12 or more nearly equal roundish or ovoid spikelets, contiguous in an oblong or crowded in a spherical or ovoid head, naked or subtended by a scale-like or foliaceous bract, that sometimes exceeds the stem: perigynium membranous, spreading or divergent, ovate, lanceolate, or narrowly elliptical, attenuate to a longer or shorter obliquely cut entire (at length bidentate) fuscous beak with a white orifice and marked by a long fissure on the outer side, plano-convex, narrowly winged, serrate above on the sharp margins, slenderly nerved, longer than the scale: nutlet oval or nearly orbicular, lenticular, chestnut-colored, shining. — Am. Journ. Sci. xxix. 246; Fl. Dan. t. 2367; Anders. Cyp. 63, t. 4, fig. 27.

Var. **Haydeniana.** Stem 4 to 8 inches high: bracts scale-like and cuspidate: spike dense, ovate or nearly round, of about 6 spikelets: perigynium tawny, ovate, tapering to a long obliquely cut beak: nutlet elliptical. — *C. Haydeniana*, Olney, Bot. King Exp. 366.

Var. **gracilis**, Olney. Stem very slender, nodding at top, 2 to 2½ feet high: spike oblong, 1 to 1½ inches long, of from 3 to 6 roundish contiguous or approximate ferruginous spikelets: perigynium of the normal form: nutlet orbicular or obovate, larger in proportion to the perigynium.

In the Coast Ranges, from Monterey (in woods among grass, the stems sometimes rooting, *Brewer*, n. 697) to Ukiah (*Bolander*), and in the Sierra Nevada, at 4,000 to 9,000 feet altitude; ranging from Greenland and Arctic America southward in the mountains to New Mexico and California, and in the Andes of South America to the Straits of Magellan. The variety *gracilis* is peculiar to California and is found both in the Coast Ranges and in the Sierra Nevada. It is taller, more slender and more loosely flowered than the species proper, but is connected with it by intermediate forms. It is like Coulter's n. 1622, which Dr. Boott in Ill. Car. 154 referred to *C. propinqua*, Nees & Meyer. But Kunth describes *C. propinqua* as having a nerveless perigynium, spongy at base, while the perigynium of the Californian plant is nerved, wholly membranous, and sharply margined at base. As these differences appear to distinguish it from *C. propinqua*, the name suggested by the late Mr. Olney is here adopted. The var. *Haydeniana* has been found on Mount Dana (*Bolander*, n. 5074), and in the Uinta Mountains, Utah, *Hayden*. *C. festiva* in its looser flowered forms is probably not distinct from *C. leporina*.

20. **C. subfusca.** Cespitose: stem 1 or 2 feet high, slender, rather obtusely angled, smooth: leaves flat, 1 to 1½ lines broad, shorter than the stem: bracts scale-like, the lowest subulate-pointed, rarely exceeding its spikelet: spike oblong, 6 to 9 lines long, of from 4 to 6 crowded round or oblong spikelets, 3 lines long, the lowest often distinct; scales tawny with pale midnerve and hyaline margins, acute or cuspidate, the midnerve scabrous at top: perigynium pale, 1½ lines long, ovate or round, acuminate-rostrate, the obliquely cut beak entire with a long fissure on the outer side extending as far as the nutlet, narrowly winged to the base, very convex on the outer side, strongly nerved, spreading, a little longer than the scale.

Lake Tahoe (*Kellogg*), and near Virginia City, Nevada, *Bloomer*.

21. **C. athrostachya**, Olney. Cespitose: stem acutely triangular, leafy, 8 to 24 inches high: leaves narrow, shorter than the stem: bracts with an expanded

strongly nerved hyaline-margined base, the lower 3 to 5 foliaceous, much exceeding the stem: spike globose, capitate, involucrate, straw-colored, of from 5 to 20 densely crowded spikelets, or the lowest distinct; scales membranous, pale-ferruginous, ovate-lanceolate, acuminate: perigynium ovate-lanceolate, attenuate to an elongated sharply bidentate beak, the winged margins serrate, slenderly nerved, spongy at base, about as long and broad as the scale: nutlet oval, lenticular. — Proc. Amer. Acad. vii. 393, and Bot. King Exp. 366.

In the Sierra Nevada, from the Yosemite Valley northward; near Virginia City and on the Truckee River, Nevada; also in Colorado. Allied to *C. sychnocephala*, Carey, from which it differs in its shorter leaves, more numerous spikelets, bracts expanded at base into a membranaceous border, and broader and more ovate irregularly nerved perigynium. — *Olney.* The perigynium is marked with a dark fissure extending from the beak as far as the nutlet.

22. **C. straminea,** Schk., var. **congesta,** Boott. Stem ½ to 2 feet high, obtusely angled, nearly smooth: leaves flat, 1½ or 2 lines broad, shorter than the stem: bracts membranous, scale-like, not exceeding the spikelets or rarely the lowest foliaceous and exceeding the stem: spike variegated, pale green and chestnut, ½ to 1 inch long, ¾ of an inch thick, oblong, triangular-ovoid, or subspherical, of from 3 to 8 crowded ellipsoidal spikelets a half-inch long and 3 lines thick or less; scales chestnut-colored, pale in the middle, with narrow hyaline margins, ovate, acute: perigynium chestnut-colored in the middle, pale green on the sides, broadly ovate or roundish, abruptly attenuate to a sharp minutely bidentate beak, with a long fissure on the outer side, broadly wing-margined to the base, finely serrate on the indented margins, compressed, wrinkled and nerved, longer and broader than the scale: nutlet (immature) oblong, lenticular. — Olney, Proc. Amer. Acad. vii. 393.

In the Sierra Nevada, in dry soil, at an altitude of from 5,000 to 11,000 feet, from Ebbett's Pass to Lassen's Peak and Mount Shasta. The species is a very variable one, and ranges from Arctic America to Pennsylvania, Texas and New Mexico.

* * * *Spikelets distinct.*

\+ *Spikelets male at top.*

23. **C. vallicola,** Dewey. Stem 6 to 12 inches high, very slender, slightly scabrous: leaves half a line broad, shorter than the stem: bracts roughly cuspidate from a broad hyaline-margined base, the lowest equalling or exceeding its spikelet; spike ½ to 1 inch long, linear-oblong, of from 4 to 7 narrowly oblong contiguous sessile spikelets; scales chestnut-colored, membranous, with very broad hyaline margins, clasping at base, broadly ovate, acute or the scabrous keel prolonged to a short mucro: perigynium pale brown, obovate, abruptly attenuate to the base and to the obliquely cut entire beak, the margins of the orifice white, convex on the outer side, concave on the inner, nerveless, sparsely serrate above on the obtuse margins, about as long as and narrower than the scale. — Am. Journ. Sci. 2 ser. xxxii. 40.

In sphagnous swamps near Mendocino City (*Bolander,* 4746 in part); Southeastern Idaho, *Hayden.*

24. **C. tenella,** Schk. Loosely tufted, stoloniferous: stem filiform, 5 to 20 inches high, scabrous above: leaves ½ to ¾ of a line broad, flat, about equalling the stem: bracts ovate-lanceolate, more or less cuspidate or the lowest filiform, an inch long or less: spike pale, linear-oblong, 8 to 14 lines long and a line thick, of 2 to 6 small round 2–6-flowered spikelets, the upper contiguous, the lower remote, the male flowers (1 to 3) inconspicuous (the upper two spikelets rarely wholly male and the lowest sometimes compound); scales hyaline with green midnerve, the male lanceolate, acute, the female ovate, obtuse or acute or mucronate, pale ferruginous: perigynium ellipsoidal or oblong, contracted at base, biconvex, obtuse, abruptly or gradually narrowed to a minute entire beak, coriaceous, closely striate-nerved, dark brown at maturity, longer than the scale: nutlet closely conformed to the perigynium, oval, biconvex, ferruginous, shining: stamens 2: base of style persistent.

— Car. fig. 104; Boott, Ill. i. 47, t. 125, 126. *C. disperma*, Dewey, Am. Journ. Sci. viii. 266. *C. gracilis*, Gray, same, 2 ser. iv. 19.

In the Sierra Nevada, Butterfly Valley (*Lemmon*); Oregon (*Douglas, Scouler*); from Arctic America to the northern Atlantic States, New Mexico and Utah; also in northern Europe.

+— +— *Spikelets male at bottom.*

25. **C. canescens,** Linn. Stoloniferous: stem weak, a foot or two high: leaves flat, ½ to 1¼ lines broad, acuminate, the upper equalling or exceeding the stem: spike pale or glaucous, 10 lines to 5 inches long, of from 3 to 10 densely flowered ellipsoidal or obovoid spikelets 2 to 7 lines long and 3 lines thick, approximate or remote, or the upper contiguous and the lower remote, the uppermost tapering to the base and the lowest rarely compound, naked or the lowest subtended by a narrow bract that rarely surpasses the stem; scales membranous, hyaline, white or fulvous with prominent green keels, the male lanceolate, the female ovate or ovate-lanceolate, obtuse or acute or mucronulate: perigynium oval or ovate, abruptly terminated by a very short nearly entire beak, short-stipitate, plano-convex, many-nerved, granular, scabrous on the upper margins, spongy at base, equalling or longer than the scale: nutlet oval or obovate, lenticular, nearly as long as the perigynium. — Fl. Dan. t. 285; Reichenb. l. c., t. 206; Boott, Ill. iv. 154, t. 496. *C. curta*, Good.; Eng. Bot. t. 1368; Schk. Car. 53, fig. 13.

At Clark's Ranch on the Merced, *Torrey*, n. 548. From Arctic America to the northern Atlantic States, and rarely in the Rocky Mountains to Colorado; also in the Andes from Chili to the Straits of Magellan, and in Europe and northern Asia.

26. **C. Deweyana,** Schwein. Cespitose: stem ½ to 4 feet long, sharply angled, scabrous, slender, weak and often decumbent: leaves flaccid, 1 or 2 lines broad, shorter than the stem: lowest bract setaceous, seldom exceeding the stem, the upper shorter or scale-like: spikelets 3 to 6, whitish-green becoming yellowish, ellipsoidal, loosely few-flowered, sparingly male at base (rarely some wholly male, or male at top and bottom, or wholly female), the upper contiguous, the lower one or two remote; scales ovate or lanceolate, acute, mucronate, white-hyaline, somewhat 3-nerved: perigynium very thin, oblong-lanceolate, acuminate to a rough serrate margined bidentate beak, spongy at base, plano-convex, obsoletely nerved, longer than the scale: nutlet closely invested by the perigynium, oblong-ovate, produced at base, lenticular, chestnut-colored, shining: style enlarged at base. — Ann. Lyc. N. York, i. 62; Boott, Ill. i. 27, t. 70.

Var. **Bolanderi.** Stem stouter and leaves broader: spikelets 5 or 6, or rarely 4 to 10, and with more numerous (10 to 30) flowers; the scales hispid-awned. — *C. Bolanderi*, Olney, Proc. Amer. Acad. vii. 393.

In Napa Valley (*Thurber, Bigelow*), on shady hillsides. From Arctic America to the northern Atlantic States, and in the Rocky Mountains to New Mexico; on the Fraser River (*Lyall*) and Columbia River, *Scouler*. The variety is rather frequent in the Sierra Nevada from the Yosemite Valley northward to the Columbia; also found near Oakland, *Bolander*, n. 22.

27. **C. sterilis,** Willd. Cespitose: stem 9 to 22 inches high, scabrous: leaves ½ to 1 line broad, often involute: spikelets 4 to 8, male or rarely female or more commonly androgynous (male at either or both ends), or the upper male and the others female or androgynous (sparingly male at base), the male ellipsoidal and female spherical, mostly contiguous or the lowest subremote, naked or the lowest setaceously bracted and very rarely compound: perigynium at maturity olive-colored or ferruginous, ovate, tapering from a sharply margined cordate base to an acutely bidentate beak, compressed, nerved, serrate on the upper margins, divergent or recurved, about equalling the ovate acute or cuspidate chestnut-colored hyaline-margined scale: nutlet suborbicular, lenticular, produced at base, yellowish, apiculate with the enlarged base of the style. — Schk. Car. fig. 146; Boott, Ill. i. 55, t. 146.

Swamps near Mendocino City (*Bolander*, n. 4739, 6193); eastward, from Canada to Texas.

28. **C. echinata,** Murr. Cespitose: stem ½ to 2 feet high, few-leaved: leaves flat and grass-like, ½ to 1 line broad, much shorter than the stem: lower bract subulate from a lanceolate base, longer or shorter than its spikelet: spikelets 3 or 4, approximate or remote, spherical, the uppermost tapering at base; scales membranous, ferruginous or white-hyaline with green midnerves, ovate, obtuse or acute: perigynium greenish straw-colored, ovate-lanceolate from a round or ovate spongy base, attenuate to a sharply bidentate beak, plano-convex, serrate-ciliate above on the acute margins, many-nerved, squarrose-spreading or recurved, twice longer than the scale: nutlet suborbicular, lenticular, yellowish, tipped with the enlarged base of the style. — *C. stellulata,* Good.; Schk. Car. fig. 14; Reichenb. l. c., t. 214. *C. muricata,* Huds.; Fl. Dan. t. 284.

At the Calaveras Grove, and in swamps in the Red Mountains, Mendocino County (*Bolander*); also in swamps near Santa Rosa (*Bigelow*); Oregon (*Hall*); and from Sitka and British America to Florida, Colorado and Arizona.

29. **C. arida,** Schwein. & Torr. Stem 2½ to 3 feet high, sharply angled above, scabrous: leaves 2 lines broad, attenuate to a setaceous summit, longer or shorter than the stem, sheathing about two-thirds of its length, the inner side of the sheaths herbaceous, entire: bracts scale-like and cuspidate, or the lowest herbaceous and filiform, exceeding the stem: spike pale, 2½ to 3½ inches long, oblong-cylindrical, of 8 to 10 elliptical spikelets 8 to 14 lines long and 1½ to 3 lines thick, acute at each end, simple or the lower compound; a second spike of 4 or 5 spikelets rarely occurs, ½ to 4 inches below the upper and on a peduncle 1 to 1½ inches long; scales hyaline, white or of a pale fulvous hue, with a green midnerve, the male ovate, obtuse, the female lanceolate and acute: perigynium 4 or 5 lines long and 1 broad, lanceolate, produced at base, acuminate-rostrate, bifid, winged, ciliate-serrate on the sharp margins, 4–5-nerved in the middle, more than twice the length of the scale: nutlet linear-lanceolate, sessile, dark brown. — Cyp. 312, t. 24; Boott, Ill. i. 20, t. 54.

In the Sierra Nevada (*Kellogg*), locality not noted; Atlantic States from Ohio to Wisconsin and Kentucky.

30. **C. scoparia,** Schk., var. **fulva.** Stem 2 feet high or more, smooth: leaves 2 lines broad, shorter than the stem: spike ovoid or oblong, of 8 to 12 crowded or contiguous sessile spikelets, naked or the lowest with a setaceous bract dilated at base and shorter than the stem: perigynium pale fulvous, narrowly lanceolate, attenuate-rostrate, sharply bidentate, narrowly winged, serrate on the margins, longer than the membranous fulvous or ferruginous lanceolate sharp-pointed scale: nutlet oval, lenticular, short-stipitate, chestnut-colored, shining, much shorter than the perigynium. — Schk. Car. fig. 175, and Boott, Ill. iii. 116, t. 368, the typical form.

In the Sierra Nevada; at Big Trees (*Hillebrand*, n. 2317); from the head of the Tuolumne to Ebbett's Pass and Silver Valley (*Brewer*, n. 1774, 1969, 2020, 2079); Oregon, *Hall, Howell.* The whole plant of a light fulvous color, smoother and stouter than the eastern form, which is found from Arctic America to South Carolina.

31. **C. lagopodioides,** Schk. Cespitose: stem 2 to 2½ feet high, sharply angled, scabrous, many-leaved below the middle: leaves 1½ to 3 lines broad, tapering to a very slender summit, the upper equalling the stem; sheaths sharply triangular, loose, enlarging upward: lowest bract foliaceous, often far exceeding the stem: spikelets pale green becoming straw-color, numerous (10 to 15 or more), ellipsoidal or obovoid, obtuse, crowded in an oblong head or contiguous, the lowest often remote on a long peduncle and compound; scales membranous, acute or acuminate: perigynium closely imbricated, elliptical or lanceolate, gradually more or less beaked, narrowly winged, the margins serrate, nerved, longer than the scale: nutlet loosely invested by the perigynium, elliptical, stipitate, lenticular, chestnut-colored. — Car. fig. 177; Boott, Ill. iii. 116, t. 370, 371.

Collected in California by *Thurber*, but locality uncertain. The species ranges eastward from Canada to South Carolina and Texas.

32. **C. cristata**, Schwein. Cespitose: stem 2 to 2½ feet high, sharply angled, scabrous: leaves 1 to 3 lines wide, attenuate at the apex, their sheaths sharply triangular, loose: bracts scale-like or the lowest foliaceous and exceeding the stem: spike oblong or cylindrical, 1 to 1½ inches long and 4 to 6 lines thick, of 8 to 12 or more closely aggregated globular spikelets; scales membranous, lanceolate, obtuse: perigynium oval or ovate, rostrate, bidenticulate, narrowly winged, ciliate-serrate on the sharp margins, spreading or recurved, much longer than the scale: nutlet round-oval, lenticular, ferruginous: style slightly thickened at base. — Cyp. l. c. 315, t. 25, fig. 1; Boott, Ill. iii. 117, t. 372, 373.

Var. **mirabilis?** Less rigid: spike looser and spikelets less spreading: perigynium longer beaked: scales pale chestnut, acute. — Boott, l. c., t. 374. *C. mirabilis*, Dewey, Am. Journ. Sci. xxx. 63.

In the Yosemite Valley and from Santa Rosa to Ukiah, *Bolander*, n. 1642, 3864, 6216. The typical form of the species ranges from Arctic America to the northern Atlantic States and Oregon; the variety from New England to Ohio, and has also been collected on the Columbia River.

33. **C. adusta**, Boott. Cespitose: stem 1 or 2 feet high, obtusely angled, often inclined at top: leaves flat, a line or two broad, shorter than the stem: bracts without sheaths, the lower foliaceous, the upper scale-like: spike oblong, of 4 to 10 clavate or roundish pale or straw-colored spikelets, the lower more or less remote and occasionally compound; scales membranous, white or ferruginous or straw-colored, lanceolate or ovate-lanceolate, acute: perigynium ovate, oval or orbicular, gradually rostrate, bidentate, the upper margins narrowly winged and serrate, the lower obtuse, turgid on the outer face, flat on the inner, strongly many-nerved, about equalling the scale: nutlet suborbicular, biconvex, sessile, chestnut-colored. — Hook. Fl. Bor.-Am. ii. 215, and Ill. iii. 119, t. 379–383. *C. argyrantha*, Tuckerman; Dewey, l. c. 2 ser. xxix. 346, a delicate form.

Var. **congesta.** Spikelets of a light fulvous color, 6 to 8, crowded in an ovate or oblong head: perigynium with longitudinal furrows, which conceal the nerves.

In the Sierra Nevada, at the Calaveras and Mariposa Groves and at Westfall's meadows (*Bolander*); the variety mostly at higher altitudes, from Silver Valley and Lassen's Peak (*Brewer*, n. 1977, 2178), and also from Calaveras Grove, *Hillebrand*, n. 2310. The species ranges from Greenland and Arctic America to Pennsylvania, the Rocky Mountains of British America, and Oregon.

§ 3. *Uppermost spikelet androgynous, male at base; the rest female: stigmas* 3.

34. **C. Buxbaumii**, Wahl. Stoloniferous: stem 1 to 2¼ feet high, scabrous above on the sharp angles: leaves firm, a line or two broad, shorter than the stem, the lower surface densely punctate and the purple sheaths fibrous-reticulate: bracts clasping without sheaths, the lowest rarely exceeding the stem: spike of from 3 to 5 erect purple and glaucous spikelets, ¾ to 2 inches long and 2 to 4 lines thick, the uppermost obovoid or club-shaped, male at bottom or rarely at both top and bottom, or entirely male and cylindrical, the rest female, oblong or oblong-cylindrical, densely flowered, contiguous and sessile or the lowest 1½ to 3 inches distant on a short peduncle; scales purple, pale in the middle, oblong or ovate-lanceolate, acute or acuminate or cuspidate, the cusp mostly smooth: perigynium glaucous, ellipsoidal, ventricose, unequally 3-angled below, very short-beaked with the orifice emarginate or rarely entire, granular, smooth on the margins, more or less prominently nerved, broader and shorter than the scale: nutlet obovoid-triangular, much shorter than the perigynium, chestnut-colored. — Fl. Dan. t. 1406; Reichenb. l. c., t. 235; Boott, Ill. iv. 136, t. 438, 439.

At Soda Springs on the Tuolumne, at 9,700 feet altitude (*Bolander*, n. 5056); ranging from Sitka and British America to Georgia, and in the Rocky Mountains to Colorado; also in Europe, Asia and Australia.

35. **C. bifida**, Boott, ined. Stem 2 or 3 feet high, acutely angled, slightly scabrous at top: leaves pale, 2 lines broad, shorter than the stem, the lower surface

densely punctate and the lower reddish sheaths sparingly fibrous-reticulate: bracts foliaceous, without sheaths, the lowest much exceeding the stem, the next above exceeding its spikelet and sometimes the stem; auricles ferruginous, oblong: spike 1½ to 2 inches long, of from 3 to 6 purple and glaucous densely flowered spikelets 3 to 9 lines long and 3 lines thick, the uppermost obovoid or clavate, male at least below, the others female, ellipsoidal, sessile and contiguous or the lowest an inch distant on a very short included peduncle; scales purple, pale in the middle, oblong or ovate, acute, ciliate at top or roughly cuspidate: perigynium triangular-ovoid, ventricose, tapering to a bidentate orifice or short beak, the upper margins serrate and the teeth hispid, sessile, nerved, not granular, longer and broader than the scale: nutlet triangular-obovoid, produced at base, much shorter than the perigynium, punctate, chestnut-colored.

In the Coast Ranges; Salinas Valley, in rather dry soil (*Brewer*, n. 574); Pacheco Pass, Santa Clara County (*Bolander*, n. 4837) and Red Mountain, Humboldt County, *Bolander*, n. 6476. Differing from the last in the longer bracts, the serrate margins of the perigynium, the longer hispid teeth, and the shorter scales. Dr. Boott in a letter of 24th April, 1863, named the Salinas plant *C. bifida*, but gave no character.

36. **C. atrata,** Linn. Cespitose: stem ½ to 2½ feet high, often cernuous at top: leaves 1½ to 4 lines broad, shorter than the stem: bracts without sheaths, the lowest about equalling the stem; auricles purple, often connate: spike ½ to 1½ inches long and 4 to 8 lines thick, of 3 to 6 ellipsoidal or oblong-cylindrical spikelets 6 to 18 lines long, contiguous, sessile and erect or peduncled and drooping, the lowest rarely subradical, the uppermost male at base or rarely entirely so, the rest female or very sparingly male at bottom; scales dark or reddish purple, ovate and obtuse or acute, or the upper lanceolate and acuminate or cuspidate: perigynium membranous, yellowish or more or less ferruginous, elliptical, round-oval, or obovate, compressed above, triangular below, abruptly or gradually rostellate with an emarginate or bidentate purple orifice, smooth, granular, nerveless, broader and longer or shorter than the scale: nutlet olive-colored, triangular-ellipsoidal, attenuate at base, much shorter than the loosely investing perigynium. — Reichenb. l. c., t. 236 (*C. aterrima*, Hoppe), 237; Boott, Ill. iii. 114, t. 362–365.

Var. **nigra,** Boott. Spikelets roundish, capitate: scales obtuse or abruptly apiculate with the nerve projecting: perigynium often scabrous. — Ill. t. 363. *C. nigra*, All.; Reichenb. l. c., t. 236.

Var. **erecta.** Stem 1½ to 3½ feet high, sharply angled, smooth or scabrous above: leaves flat, 1 to 2½ lines broad, the sheaths purple: lowest bract foliaceous, about equalling the stem, the rest scale-like and cuspidate, shorter than their spikelets: spike purple, oblong, 1 to 3 inches long, of 3 to 6 erect spikelets ¼ to 1 inch long and 1 to 3 lines thick, the uppermost clavate (rarely wholly male and cylindrical), the others oblong, crowded, sessile, or the lowest 1½ inches distant, or less, and peduncled; peduncle not exceeding 1½ inches in length; scales purple with pale midnerve, ovate or lanceolate, cuspidate: perigynium membranous, more or less purple or ferruginous with pale margins, obovoid, compressed-triangular, abruptly ending in a very short cylindrical sharply bidenticulate beak, granular and nerveless or obscurely nerved: nutlet chestnut-colored, stipitate, much shorter than the perigynium.

In the Sierra Nevada, not rare, from 5,000 feet (Big Trees, *Bolander*) to 10,000 or 12,000 feet altitude, both the typical form and the varieties. The species is a very variable one and widely distributed, ranging in America from Greenland and the Arctic Ocean to the White Mountains, Colorado and Utah, Northern Nevada and California, and also frequent in the alpine regions of Europe and Asia. The stamens, according to Goodenough, are sometimes only 2; stigmas 3 or 2. An empty short-sheathed bract is often found an inch or two below the spikes.

37. **C. heteroneura.** Stem 2 feet high, slender, sharply angled, smooth: leaves 1½ or 2 lines broad, flat, shorter than the stem: bracts clasping, the lower two foliaceous, about equalling the stem; auricles small and scarious, pale: spikelets 4 or 5;

the male cylindrical or slightly clavate, obtuse, peduncled, single or with a much smaller one at its base; the female 3, oblong or clavate, 3 to 9 lines long, the uppermost sessile (sometimes male at base), the rest short-peduncled, contiguous or the lowest rarely 4 inches distant; scales purple with pale midnerve and hyaline margin, obtuse, the male oblong, the female shorter and ovate: perigynium oval, subcompressed-triangular, obtuse, ending abruptly in a minute purple emarginate beak, pale or tinged with purple, nerveless excepting 2 intramarginal nerves and 2 short ones diverging from the base of the beak, much longer and broader than the scale: nutlet triangular-ellipsoidal.

In the Sierra Nevada; Lake Tahoe to Bear Valley, *Kellogg*.

§ 4. *Spikes unisexual (the male above and mostly single, the rest female), or sparingly androgynous.*

* *Stigmas* 2.

+ *Perigynium beakless or nearly so.*

38. **C. aurea**, Nutt. Stoloniferous, glaucous: stem 1 to 15 inches high, slender: leaves flat, 1 to 1½ lines broad: bracts foliaceous, sheathed, the lower much exceeding the stem: sheaths 1 to 15 lines long: spikes 3 to 6, the uppermost cylindrical, male, or female at top, 4 to 6 lines long, the rest female, oblong, 3 to 10 lines long and 2 broad, loosely flowered, peduncled, the upper contiguous, the lower remote, the lowest often radical and compound; peduncles from 2 lines to 6 inches long; scales ferruginous, pale in the middle and with hyaline margins, broadly ovate, obtuse or abruptly cuspidate, 1–3-nerved: perigynium globose or pear-shaped, turgid, obtuse or abruptly and minutely beaked with entire orifice, coriaceous, spongy at base, orange-colored becoming ferruginous, strongly nerved, longer than and as broad as the scale: nutlet dark brown, orbicular, produced at base, biconvex or rarely triangular: stigmas rarely 3. — Schwein. & Torr. Cyp. 328, t. 25, fig. 2; Boott, Ill. i. 29, t. 76.

In the Sierra Nevada, at Soda Springs on the Tuolumne River (*Bolander*, n. 6220) and Plumas County (*Mrs. Austin*), and at Mono Lake, *Brewer*, n. 1839. A strongly marked species, peculiar to North America, ranging from subarctic regions to the northern Atlantic States and in the western mountain ranges to Colorado, Southern Utah, Nevada and California.

+ + *Perigynium short-beaked.*

39. **C. Kelloggii.** Stem very slender, 12 to 16 inches high, sharply angled and scabrous above: leaves 1½ lines broad, the cauline shorter, the sterile rather longer than the stem; bracts without sheaths, the lowest slightly exceeding the stem, the next above its spike; auricles oblong, ferruginous: spikes 4 or 5, narrowly cylindrical or clavate, contiguous, sessile or the lowest 1½ inches distant, short-peduncled and loosely flowered at base, the male (rarely female at top or at bottom) ¾ of an inch long, the female 3 to 12 lines long, about a line thick; scales purple with pale midnerve, the male obovate, the female oblong, obtuse: perigynia pale, ovate, tapering to a short beak, the orifice entire, purple, acute at base, short-stipitate, biconvex below, compressed and slightly excurved at top, smooth, obscurely nerved, longer than the scales: nutlet of a dull chestnut, obovate, abruptly tipped with the persistent style, half the length of the perigynium.

In the Sierra Nevada, at Alta and from Lake Tahoe to Bear Valley (*Kellogg, Lemmon*); Wahsatch Mountains, Utah, *M. E. Jones*.

40. **C. vulgaris**, Fries, var. **alpina**, Boott. Stoloniferous: stem 12 to 18 inches high, sharply angled, several-leaved at base: leaves 2 lines broad, lance-linear, flat, erect, equalling or shorter than the stem; auricles purple, the lowest small, round, separate: spikes 3 to 5, dark-purple, 3 to 9 lines long and 2 thick, short-peduncled, contiguous or the lowest 1 or 2 inches distant, the upper one or

two male or sometimes female at top or at the bottom, the rest female or with male flowers at top; scales dark purple, oblong or ovate or lanceolate, obtuse or acute: perigynium ferruginous or pale below, round-obovate, abruptly ending in a very short entire beak, or ovate and acute, curving outward, smooth or few-toothed on the upper margins, compressed, nerveless, longer or shorter than the scales: nutlet obovate, lenticular: stigmas 2 or 3. — Ill. iv. 167, t. 568–575. *C. rigida*, Good. Linn. Trans. ii. 193, t. 22; Reichenb. l. c., t. 225. *C. saxatilis*, Fl. Dan. t. 159.

In the Sierra Nevada, from the Yosemite Valley to Mount Shasta, mostly alpine at 8,000 to 12,000 feet altitude. A very variable species and widely distributed, ranging in America, in several forms, from Greenland and Behring Straits to the northern Atlantic States, Colorado and westward, and also found in Chili, and in the Old World frequent in the alpine or colder regions of Europe, Asia and Australia. The var. *hyperborea*, Boott (to which are referred *C. hyperborea*, Drej., *C. limula*, Fries, *C. Bigelovii*, Torr., and *C. Washingtoniana*, Dew.), differs chiefly in its usually slightly nerved perigynium and longer and looser spikes.

41. **C. decidua**, Boott. Stem 1 to 1½ feet high or more: leaves 1 to 3 lines broad, shorter than the stem: bracts without sheaths, the lower exceeding the stem; auricles purple, roundish or clasping: spikes dark purple, 4 to 6, oblong or cylindrical, the uppermost male at least at base or at both ends, 12 to 14 lines long and 2 or 3 thick, the rest female and solitary or in clusters of two or three, 6 to 18 lines long or more by 2 to 4 thick; scales dark purple, pale in the middle, oblong-oval, the male obtuse or the midnerve slightly projecting in the upper flowers, the lower female sometimes lanceolate and mucronulate: perigynium ferruginous, oval, rostellate with an entire beak, stipitate, strongly nerved, smooth or dentate on the upper margins, papillose, deciduous, longer or shorter than the scale: nutlet oval, lenticular, punctate. — Linn. Trans. xx. 119, and Ill. i. 63, t. 170.

Western coast of Patagonia and the Falkland Islands; inserted on the authority of Dr. Boott, who cites under this species specimens collected in California by *Thurber* and in Oregon by *Douglas*, *Hinds*, and *Nuttall*.

42. **C. nudata.** Stem 12 to 16 inches high, slender, sharply angled, scabrous, clothed at base with dark brown leafless sheaths, the inner side breaking up in reticulate fibres: leaves 1 to 2½ lines broad, setaceously pointed, shorter than the stem: bracts without sheaths, the lowest rarely equalling the stem, the rest shorter than the spike; auricles purple, oblong: spikes 4 or 5, cylindrical, the uppermost male (or female at base), 6 to 12 lines long and 1 to 1½ thick, single or rarely with a second smaller one at its base, the others female, 6 to 18 lines long and 1 or 2 thick, the highest close to the male and sessile, the rest contiguous on short peduncles or rarely the lowest radical on a peduncle a foot long; scales dark purple, oblong, obtuse, or the lower female lanceolate and acute: perigynium purple above, straw-colored below, elliptical, attenuate to an entire cylindrical beak, compressed and empty above, plano-convex below, delicately nerved, punctate, resinously dotted, very deciduous, longer or shorter than the scale: nutlet (young) loosely invested by the perigynium and half its length, orbicular.

In the Coast Ranges from San Francisco Bay to Ukiah, *Bolander*, n. 2299, 3836, 4638, 6202.

43. **C. aquatilis**, Wahl. Stoloniferous: stem stout, obtusely angled, smooth, spongy at base, 2 or 3 feet high: leaves pale, 1½ to 3 lines broad, often exceeding the stem: bracts foliaceous, clasping, without sheaths, the lower much longer than the stem; auricles small, roundish, separate or connate: spike 6 to 12 inches long, of from 4 to 8 cylindrical or clavate spikelets, the male 1 to 4, approximate, an inch or two long, the lowest often bracted, the female 2 to 5, densely flowered, obtuse or the upper one male at top, 1½ to 3 inches long and 2 or 3 lines thick, remote, sessile or the lower peduncled and loosely flowered at base; scales purple or chestnut-colored, pale in the middle and on the margins, oblong or lanceolate, obtuse or acute or the lower rarely 3-nerved and cuspidate: perigynium pale, obovate, round or elliptical, short-beaked with entire orifice, stipitate, biconvex, nerveless or 1–2-nerved on the outer side, resinously dotted, broader than the scale: nutlet round or

obovate, lenticular or oval and triangular, chestnut-colored: stigmas rarely 3. — Reichenb. l. c., t. 234; Boott, Ill. iv. 163, t. 542–545.

Santa Clara Valley, 12 miles from San Jose, *Bolander*. From Arctic America to the northern Atlantic States, Wyoming and Washington Territory; also in Europe and northern Asia.

44. **C. angustata,** Boott. Densely cespitose: stem 2 to 3½ feet high, sharply angled and very scabrous: leaves green or glaucous, 1 or 2 lines broad, scabrous, shorter than the stem; lower sheaths conspicuously fibrous-reticulate: bracts foliaceous, without sheaths, the lowest shorter than or slightly exceeding the stem; auricles purple or ferruginous, small, round or oblong: spikelets 3 to 6, ½ to 3½ inches long and 1 to 3 lines thick, the male 1 to 3 and contiguous, the female 1 to 4 (the upper or all male at top or to below the middle) contiguous or remote, sessile or the lower peduncled and loosely flowered at base; scales purple with green midnerve, lanceolate, obtuse or acute: perigynium oval, ovate or elliptical, beakless or gradually or abruptly short-beaked with entire or emarginate orifice, compressed, granular, smooth or rarely 1–2-toothed on the upper margins, nerveless or 1–4-nerved, broader and longer or shorter than the scale: nutlet chestnut-colored, orbicular. — Hook. Fl. Bor.-Am. ii. 218, and Ill. iv. 173, t. 586–588. *C. stricta,* Torr., etc., not of Goodenough.

On the American River, among rocks (*Bolander*, n. 4534); also in Matilija Cañon (*Peckham*); from Canada to Florida and Texas, and in Colorado.

45. **C. senta,** Boott. Stem (lower part wanting) 18 inches high, sharply angled, scabrous: leaves glaucous, 2 lines broad, shorter than the stem; lower sheaths purple, scabrous, the margins fibrous-reticulate: bracts without sheaths, narrow, the lowest shorter than the stem; auricles purple, roundish, small: spikes 3 or 4, purple, 1 to 1½ inches long, cylindrical-oblong, densely flowered, erect; female two, the upper sometimes male at top and in the middle, on very short included peduncles (1 or 2 lines long) and enclosed at base in a purple sheath; scales purple, pale in the middle, oblong, obtuse or the upper acute or tipped with an abrupt short rough mucro: perigynium more or less purple, ovate, rostellate with entire orifice, compressed, slenderly nerved, toothed on the upper margins, longer and broader than the scale: nutlet (immature) orbicular. — Ill. iv. 174 (under *C. angustata*).

Santa Inez Mountains, in cañon 20 miles northeast of Santa Barbara, on road to the "Coal Mines," *Brewer*, n. 350. Dr. Boott in mentioning the species simply notices the scabrous sheaths and the toothed margins of the perigynium.

46. **C. lenticularis,** Michx. Cespitose: stem slender, 12 to 18 inches high: leaves 1 or 2 lines broad, pale, often longer than the stem: bracts foliaceous, often sheathed, the lower much exceeding the stem; sheaths 2 to 8 lines long: spikelets 6 or 7, purplish, cylindrical or clavate, the uppermost 8 to 12 lines long, often female at top, simple or with a smaller one at base, the rest female or the upper sparingly male at base, attenuate and loosely flowered, from 3 lines to 1½ or even 3 inches long and 1 to 1¼ lines thick, crowded or approximate, sessile or the lower peduncled; peduncles 2 lines to 6½ inches long; scales 1–3-nerved, oblong or ovate, obtuse, purple with the middle and margins pale: perigynium pale, ovate and attenuate or broadly oval and abruptly ending in a short cylindrical beak with entire orifice, biconvex, stipitate, nerved, granular, longer and broader than the scale: nutlet dark brown, oval or obovate, lenticular. — Boott, Ill. i. 30, t. 77.

In the Sierra Nevada, in Yosemite Valley (*Bolander*, n. 6198[2]) and at Silver Lake (*Brewer*, n. 2099); also by *Kellogg*. The species is found from Arctic America to the northern border of the Atlantic States, and was collected by *Lyall* in the mountains of Washington Territory.

47. **C. salina,** Wahl., var. **minor,** Boott. Rootstock creeping: stem 2½ to 5 inches high, obtusely angled, smooth: leaves pale, 1 to 1½ lines broad, exceeding the stem: bracts foliaceous, sheathed, commonly all exceeding the stem; sheaths 1 to 6 lines long: spikes 2 to 6, erect, ellipsoidal, the single male 3 to 6 lines long upon a peduncle 9 lines long, the female 3 to 8 lines long and 1 to 1½ lines thick,

few-flowered, the upper contiguous, the lower remote and the lowest sometimes on a subradical peduncle 2 inches long, rarely compound at base; scales purple or chestnut-colored, pale in the middle, broadly oval, the male mostly obtuse, the female obtuse or tipped with a broad rough awn, clasping the base of the perigynium, more or less 3-nerved: perigynium pale, broadly oval, nerved, the reddish orifice entire, shorter or longer than the scale; a rough whitish racheola occasionally exserted from the orifice: nutlet obovate. — Ill. iv. 160, t. 525–530. *C. subspathacea*, Wormsk. Fl. Dan. t. 1530; Kunze, Car. 98, t. 24. *C. lanceata*, Dewey, l. c. xxix. 249, t. 10, fig. 77. *C. Hoppneri*, Boott, Hook. Fl. Bor.-Am. ii. 219, t. 220.

In swamps near Mendocino City, *Bolander*, n. 4702. From Greenland and Arctic British America to New England, and on the western coast to Northern California; also in Scandinavia. *C. subspathacea* is described as having evaginate bracts and only 2 or 3 female spikelets. Dr. Boott, however, in Ill. Car. t. 530, figures a specimen with a long sheath, and the greater number of the female spikelets in these specimens does not afford sufficient reason for separating them from *C. salina*, var. *minor*, with which they agree in other respects, even in the occasional presence of the racheola noticed by Boeckeler.

48. **C. Sitchensis,** Prescott. Stem 1 to 4½ feet high, stout, sharply angled, scabrous, many-leaved at base; lower sheaths fibrous-reticulate: leaves 3 or 4 lines broad, rigid, the cauline shorter, the radical longer than the stem: bracts without sheaths, foliaceous, the lower far exceeding the stem; auricles purple, clasping: spikes dark purple, cylindrical, the male 1 to 4, sessile, 1½ to 3 inches long and 2 or 3 lines thick, the 3 to 5 female sessile or more or less peduncled, 1 to 4 inches long and 3 to 5 lines thick, the upper rarely all male at top, contiguous or remote, the lower nodding and loosely flowered and rarely compound at base; peduncles 2 to 12 inches long; scales purple, the male oblong, obtuse, the female ovate or lanceolate, acuminate or awned, rarely obtuse: perigynium purple, somewhat shining at maturity, orbicular-obovate, turgidly biconvex, abruptly short-beaked with an entire orifice, stipitate, coriaceous, nerveless, smooth or sparingly toothed on the obtuse upper margins, spreading, narrower (at base) and shorter than the scale: nutlet dark olive-colored, oblong, lenticular, indented on the sides. — Bong. Veg. Sitch. 168; Boott, Hook. Fl. Bor.-Am. ii. 220, t. 221, and Ill. iv. 195, t. 518, 519.

In salt marshes, about San Francisco Bay (*Bolander*), and northward along the coast to Sitka. Dr. Boott notices the occasional presence of a whitish racheola in this species as in the last, and there is often an abortive purple scale at the summit of the perigynium. Boeckeler (in Linnæa, xl. 419) refers *C. Sitchensis* to *C. acuta*, Linn., as a variety, while Dr. Boott thinks it merely a fuller developed form of *C. salina*.

49. **C. Jamesii,** Torr. Stem a foot or two high, sharply angled: leaves glaucous, firm, linear-lanceolate, 2 to 4 lines broad, shorter than the stem: bracts foliaceous, the lowest rarely short-sheathed, equalling or exceeding the stem; auricles oblong: spikes purple and green, cylindrical or oblong, erect, the upper 1 to 4 male, contiguous, 4 to 12 lines long and 1 to 4 thick, the uppermost the largest and rarely more or less female at top, the rest female or the upper sometimes male at top, 10 to 20 lines long and 2 or 3 thick, densely flowered, sessile or the lower peduncled, the lowest sometimes attenuate at base and loosely flowered on a subradical peduncle ¼ to 3 inches long; scales oblong or lanceolate, acute or cuspidate, purple with pale midnerve: perigynium oval or obovate, abruptly ending in a short bidentate beak with the teeth serrate, biconvex above, compressed below, smooth, strongly nerved, resinously dotted, longer or shorter than the scale: nutlet orbicular. — Cyp. 398; Boott, Ill. iv. 175, t. 592. *C. Nebrascensis*, Dewey, l. c. 2 ser. xviii. 102.

In the mountains from Washington Territory and Northern Idaho to New Mexico, Southern Utah, and California; southward in the Sierra Nevada to Kern River, *Rothrock*. Also a variety, with a shorter-beaked perigynium, often obscurely nerved, the orifice emarginate or entire, and the scales obtuse or tipped with a very short mucro; in the Santa Susanna Mountains (*Brewer*, n. 218), Ojai Ranch (*Peckham*), and at Clark's Ranch and the Yosemite Valley, *Bolander*.

50. **C. laciniata,** Boott. Stem stout, sharply angled, scabrous, 2 to 3½ feet high: leaves 2 to 4 lines broad; lower sheaths fibrous-reticulate: bracts without

sheaths, very long, the lowest sometimes 2½ feet; auricles purple, entire, truncate: spikes 4 to 6, of a yellowish ferruginous color, cylindrical, the male 1 or 2, commonly peduncled, the uppermost 1 to 3½ inches long and 2 or 3 lines thick, sometimes with a few female flowers above the middle or at the base, the rest female (the upper ones or all male at top), 2 to 3½ inches long and 2 to 4½ lines thick, remote, densely flowered, the upper sessile, the lower nodding on long peduncles (2½ inches long or less) and loosely flowered at base; scales purple or ferruginous, pale in the middle, lanceolate or oblong, ciliate, acute or with a rough awn, rarely obtuse: perigynium oval, ovate, round, or obovate, abruptly or gradually beaked with the orifice varying from nearly entire to bidentate with serrate teeth, coriaceous, sparingly toothed on the upper margins, more or less distinctly nerved, compressed-lenticular, punctate, broader than the scale: nutlet ovate, dark olive. — Ill. iv. 174, t. 594.

In the Coast Ranges and near the sea, from Santa Barbara (*Nuttall*) to Oregon.

51. **C. Prescottiana,** Boott. Stem 2 or 3 feet high, smooth, leafy at base: leaves 4 lines broad, about equalling the stem: bracts without sheaths, the lower foliaceous and much exceeding the stem: spikes 6 to 10, cylindrical, sessile, the male 1 or 2, 1 to 2½ inches long and a line thick, the rest female, 2½ to 4 inches long and 1½ to 2½ lines thick, contiguous, erect or drooping, the upper male at top: scales purple, pale in the middle, ovate or obovate, obtuse or emarginate, roughly cuspidate: perigynium broadly ovate (when young obovate), rostellate with an emarginate beak, divergent, nerved, longer and broader than the scale: nutlet chestnut-colored, obovate, lenticular, much shorter than the perigynium. — Ill. i. 45. t. 115. *C. Barbaræ,* Dewey, Am. Journ. Sci. 2 ser. xxxi. 24.

Banks of streams at Santa Barbara (*Parry*); also in the island of Hawaii.

C. Schottii, Dewey, l. c. 25, an imperfectly defined species from Santa Barbara (*Parry*), would appear to belong here. The spikes are cylindrical, very slender, the male 3 to 5, and 3 inches long, the female 3 or 4 and 4 to 8 inches long, loosely flowered, unequally peduncled: bracts foliaceous, with long sheaths; leaves and bracts glaucous: scales dark red, oblong, obovate, scarcely acute: fruit abortive.

C. Watsoni, Olney, Bot. King Exp. 370, is founded upon specimens too young for satisfactory description. The stem is 18 inches high, shorter than the upper leaves: spikelets 7, the male 4, the uppermost largest and the rest short, all aggregated; scales claret-colored, lanceolate, hispid, aristate, ciliate at the apex, the male 3-nerved: perigynium deeply cleft, the bifid beak spreading and slightly hairy. Collected at the base of the Washoe Mountains, near Carson City, Nevada, *Watson.*

* * *Stigmas 3.*

+– *Perigynium beakless or short-beaked, the orifice entire or emarginate.*

++ *Perigynium smooth.*

52. **C. livida,** Willd. Stoloniferous, glaucous: stem 4 to 17 inches high, obtusely angled: leaves rigid, 1 to 1½ lines broad, shorter than the stem: bracts clasping or sheathed, the lowest equalling or slightly exceeding the stem; sheaths 2 to 4 lines long: spikes 2 to 4, oblong, erect, the uppermost male, 5 to 12 lines long and ½ to 1 line thick, mostly peduncled, the female 1 or 2 (rarely none), 10–15-flowered, 4 to 8 lines long and 2 to 2½ thick, approximate, sessile or short-peduncled, with rarely another borne on a long radical peduncle; scales more or less purple with green midnerve and hyaline margins, ovate, obtuse, or the female sometimes cuspidate: perigynium ovoid, with a straight obtuse entire point, obtusely 3-angled, nerved, granular, rather exceeding the scale: nutlet ellipsoidal, 3-angled, produced at base, chestnut-colored, two-thirds as long as the perigynium: base of the style enlarged. — Schkuhr, Car. fig. 211; Boott, Ill. ii. 78, t. 214, 215. *C. Grayana,* Dewey, l. c. xxv. 141, t. 8, fig. 59.

In sphagnous swamps near Mendocino City, *Bolander,* n. 4745. From Sitka and subarctic America to the northern Atlantic States; also in northern Europe.

53. **C. laxiflora**, Lam., var. **plantaginea**, Boott. Cespitose: stem 12 to 18 inches high, slender, sharply angled: radical leaves 6 to 18 inches long, 5 to 7 lines broad, the cauline and lower bracts 3 or 4 lines broad, shorter than the stem, the sheath of the latter 1 to 2½ inches long: spikes 4 or 5, pale, cylindrical, an inch long or more, the male single, the female loosely flowered, 1 or 2 lines thick, the upper contiguous on enclosed peduncles, the rest remote and the lowest sometimes radical on long exserted peduncles; scales hyaline with green midnerve, ovate, obtuse or acute or cuspidate: perigynium ellipsoidal, acute at each end, obtusely angled, erect or curving outwards at top, with entire hyaline orifice, many-nerved, longer or shorter than the scale: nutlet chestnut-colored, obovoid, 3-angled, punctate. — Ill. i. 37. *C. plantaginea*, Schk. Car. fig. 195, not Lam.

Mendocino County (*Bolander*, n. 4747); Washington Territory (*Lyall*), and in the Atlantic States. The species is frequent eastward, under numerous forms, from Canada to Florida and Texas.

54. **C. podocarpa**, R. Br. Stoloniferous: stem 1 to 2½ feet high, slightly scabrous above and often cernuous: leaves 1 to 3 lines broad, shorter than the stem, the upper the longest: bracts foliaceous, without sheaths, the lowest and sometimes the lower two equalling or exceeding the stem; auricles purple, oblong, rarely clasping and sheath-like: spikes 3 to 6, ellipsoidal, oblong-cylindrical or clavate, ¼ to 1 inch long, 3 lines thick, the male single (rarely 2), the female (the upper one sometimes male at top) approximate, sessile or shortly peduncled, or all remote and more or less peduncled and the lowest pendulous on a long smooth subradical peduncle 6 or 7 inches long; scales purple, oblong or lanceolate, sometimes unequally emarginate, acute or roughly awned: perigynium blotched with purple, oval or ovate, gradually or abruptly ending in a minutely bidentate orifice or cylindrical beak, compressed above, triangular below, obscurely nerved excepting the two intramarginal veins, equalling or shorter than the scale: nutlet loosely inclosed in and much smaller than the perigynium, obovoid-triangular or lenticular, stipitate, olive-colored: stigmas 3 or 2. — Hook. Fl. Bor.-Am. ii. 224, t. 224, and Ill. iv. 197. *C. macrochæta*, Meyer, Car. Nov. 224, t. 13. *C. spectabilis*, Dewey, l. c. xxix. 248, t. 10, fig. 76.

In the Sierra Nevada, from the head of Kern River (*Rothrock*, n. 302) and northward, to Alaska; also in northeastern Asia. Very variable in the dimensions, form and position of the spikes and in the length of the beak. In one Californian specimen (*Brewer*, n. 1773ª) the stigmas are 4 or 5, in another (*Brewer*, n. 2319) the perigynia are staminiferous.

55. **C. Raynoldsii**, Dewey. Stoloniferous: stem 1 to 3½ feet high, sharply angled: leaves glaucous, 3 or 4 lines broad, flat with revolute margins, rather abruptly tapering to a triangular apex, shorter than the stem: bracts without sheaths, foliaceous, the lowest about equalling the stem; auricles purple, round or oblong: spikes 3 to 6, oblong or obovoid, the male single, 4 to 9 lines long, sessile, the female 6 to 8 lines long and 3 or 4 thick, sessile or short-peduncled, contiguous or the lowest 2 to 2½ inches distant on a peduncle 1 to 1½ inches long, occasionally compound at base, the upper often staminate at top; scales purple, or pale in the middle and on the margins, oblong or ovate, acute or acuminate: perigynium divergent and deciduous, pale yellow, obovoid, ventricose, obtusely 3-angled, abruptly rostellate with a purple emarginate beak, nerved, longer and broader than the scale: nutlet triangular-obovoid, the sides concave below, olive-colored. — Am. Journ. Sci. 2 ser. xxxii. 39.

In the Sierra Nevada, at 8,000 to 12,000 feet altitude, from Mount Dana to Silver Valley; also in Washington Territory (*Lyall*), and from Wyoming Territory to Northern Utah.

56. **C. serratodens.** Stem 1 to 1½ feet high, smooth: leaves 1½ lines broad, shorter than the stem; lower sheaths sparingly fibrous-reticulate: bracts foliaceous, clasping, narrow, the lowest exceeding the stem and the next its spikelet; auricles oblong, purple, separated or united: spikes 3 or 4, the male single, clavate, 1 to 1¼

inches long, the female 2 or 3, oblong or the lowest clavate, ½ to 1 inch long, the uppermost contiguous to the male spikelet, the others ½ to 1 inch distant, sessile; scales reddish chestnut, clasping at base, ovate or lanceolate, acute, the female rough-awned: perigynium (young) olive-colored, elliptical, acute at base, tapering to a slightly scabrous bidentate beak with spreading hispid teeth, smooth, granular, obscurely nerved, longer than the scale.

From California; in herb. Olney, but locality and collector not stated.

++ ++ *Perigynium pubescent.*

57. **C. Richardsoni**, R. Br. Stoloniferous: stem 6 to 12 inches high, obtusely angled, scabrous: leaves rigid, ½ to 1 line broad, shorter than the stem: bracts sheathing, with a very short subulate scarious-margined free apex; sheaths purple, 1 to 4 lines long: spikes 2 to 4, purple and green, oblong-cylindrical or clavate, contiguous or subremote, the uppermost male and peduncled, 4 to 12 lines long and 1 or 2 thick, the female 4 to 9 lines long and 2 thick, on enclosed or slightly exserted peduncles, sometimes compound; scales membranous, purple, pale in the middle and with broad hyaline margins, ciliate at top, the male oblong and obtuse, the female ovate or lanceolate, clasping: perigynium pale green, obovoid, unequally 3-angled, attenuate at base, abruptly rostellate with an entire hyaline orifice, membranous, pubescent, nerveless, shorter and narrower than the scale: nutlet conformed to the perigynium: style enlarged at base. — Boott, Hook. Fl. Bor.-Am. t. 223, and Ill. ii. 100, t. 298.

In the Red Mountains, Mendocino County (*Bolander*, n. 6478); eastward from Arctic America to Illinois and New York.

C. Pennsylvanica, Lam., with a range from Arctic America to the Southern States and also found on the Rocky Mountains, is very likely to occur in California. Stem 6 to 12 inches high: lower sheaths fibrous-reticulate: bracts without sheaths, scale-like, the lowest rarely subulate and equalling the stem: spikes 2 to 4, green and purple, the male sometimes female at top, the upper female contiguous, the lowest sometimes subradical and long-peduncled: perigynium globose, abruptly conically beaked, with an obliquely cut entire or bidentate orifice, produced at base, nerveless, about equalling the ovate acute or cuspidate purple scale: nutlet globose, tapering to the base: style enlarged at base.

C. Rossii, Boott, of Oregon, may reach California. Stem capillary, 6 to 9 inches high, scabrous: lower bracts sheathed, shorter than the peduncles: spikes 4 or 5, pale, the female with 3 to 6 alternate flowers, the upper close to the male, the lower remote, unequally long-peduncled: perigynium ellipsoidal, long-beaked, bifid, stipitate, nerveless, about equal to the lanceolate acute or cuspidate scale: nutlet subtriangular-globose. Referred to *C. Pennsylvanica* by Boeckeler.

58. **C. globosa**, Boott. Stoloniferous: stem 4 to 16 inches high, very slender, scabrous, clothed at base with reddish purple sheaths that break up into thread-like fibres: leaves firm, 1 or 2 lines broad, the lower longer than the stem: lower bracts short-sheathed, longer than their spikelets: spikes 4 to 6, the male cylindrical, ½ to 1 inch long and a line thick, the female oblong, loosely 2–9-flowered, 3 to 6 lines long and 2 thick, the upper sessile, close to the male and staminate at top, the others remote and pedunculate, the lowest on a rough capillary subradical peduncle a foot long or less; scales 1- and 3-nerved, oblong or lanceolate, acute or cuspidate, purple with green midnerve and hyaline margins: perigynium more or less purple, globose, produced at base, abruptly beaked with a bidentate hyaline-margined orifice, coriaceous, nerved, hirsute-scabrous, broader than the scale; nutlet chestnut-colored, oblong or globose, obtusely 3-angled, slightly produced at base. — Trans. Linn. Soc. xx. 125, and Ill. iv. 188.

In the Coast Ranges (Santa Barbara, *Brewer*, to Oakland among redwoods, *Bolander*), and in the Sierra Nevada, from the Yosemite Valley northward.

59. **C. brevipes.** Cespitose and rootstock creeping: stem 6 inches high, obtusely angled, slightly scabrous, several-leaved at base, the reddish purple sheaths breaking up into separate fibres: cauline leaves 1 or 2 lines broad, tapering to a sharp triangular scabrous summit, shorter than the stem: bracts without sheaths,

one or two of the upper exceeding the stem: spikes 3 or 4, rather loosely few-flowered, the one male linear-oblong, 3 to 5 lines long, erect or oblique, the female oblong, 2 to 4 lines long, the upper contiguous to the male and short-peduncled, the lowest remote or subradical on a peduncle an inch long or less; scales purple on the side, pale in the middle, 1 – 3-nerved, obtuse, acute or more or less roughly cuspidate, the male oblong, the female broadly ovate, clasping at base: perigynium coriaceous, hispid, triangular-subglobose, much attenuate at base, conically beaked, the beak straight or bent with a minutely bidentate orifice, obscurely striate on the lower half, longer or shorter than the scale: nutlet triangular-ovoid.

In the Sierra Nevada; Lake Tahoe to Bear Valley, *Kellogg.*

60. **C. hirtissima.** Stem 15 to 18 inches high, obtusely angled, smooth: leaves pale, flat, the cauline 1 to 1½ lines broad, somewhat 3-nerved, about half the length of the stem, hairy beneath, ciliate on the margins; sterile leaves 9 inches long and 4 to 6 lines broad: bracts foliaceous, exceeding the spikes, the lower with hairy sheaths 1 to 3 inches long: spikes 2 to 4, the male oblong or clavate, ½ to 1¼ inches long, commonly female at top and rarely at bottom; female 2, rarely 3, cylindrical, ¾ to 1½ inches long, rather loosely flowered, the upper close to the male and subsessile, the rest remote, on erect peduncles 2½ to 4½ inches long; scales membranous, very pale ferruginous with broad hyaline margins, obovate or orbicular, obtuse, ciliate on the margins, the lower abruptly hispid-awned, the upper and the male mucronate: perigynium olive-color, hirsute with stiff white hairs, triangular, ellipsoidal or obovoid, acute at base, abruptly ending in a stout cylindrical minutely bidentate beak, the lower shorter than the scale, the upper about equalling it: nutlet olive-colored, obovoid, stipitate, punctate.

In the Sierra Nevada, *Kellogg.*

61. **C. triquetra,** Boott. Stem 5 to 18 inches high, slightly scabrous: leaves pale, 1 to 2¼ lines broad, equalling or shorter than the stem: lower bracts sheathed, equalling the stem, or the lowest remote and shorter: spikes 3 to 5, oblong, the male 9 lines long and 1 thick, subsessile, the female 6 to 9 lines long and 1½ or 2 lines thick, erect, the upper approximate, the lower on enclosed peduncles or the lowest remote on a long-exserted peduncle, all with abortive flowers at top and the lowest also at bottom; scales pale chestnut, ovate, mucronate, acute or obtuse, with hyaline margins: perigynium pale, covered with long white hairs, ellipsoidal, sharply triangular, acute at each end, with a very short bidentate beak, 1 – 4-nerved on one or more of the sides, longer and broader than the scale: nutlet dark chestnut, conformed to and filling the perigynium. — Linn. Trans. xx. 126, and Ill. iv. 219, t. 417. *C. monticola,* Dewey, l. c. xxxi. 26, and Bot. Mex. Bound. 229.

Mountains east of San Diego (*Parry*); Matilija cañon, near Ojai (*Peckham*); first collected by *Nuttall,* probably near Santa Barbara.

+– +– *Beak of perigynium more or less elongated.*

++ *Beak emarginate or obliquely truncate.*

62. **C. polymorpha,** Muhl. Rootstock creeping: whole plant densely granular: stem 1 to 1½ feet high, sharply angled, smooth, clothed at base with lanceolate purple leafless sheaths: leaves rigid, 1 or 2 lines broad, with revolute margins, much shorter than the stem; lower sheaths fibrous-reticulate: bracts of the female spikes sheathed, exceeding their spikes but shorter than the stem; sheaths 3 to 12 lines long: spikes 2 to 4, cylindrical, purple, the male 1 or 2, rarely 3, 6 to 15 lines long and 1 or 2 thick, the uppermost the largest, and the lowest subtended by a clasping bract equalling or exceeding the stem; female spikes 10 to 16 lines long and 2 to 4 thick, the upper sometimes male at top, loosely flowered at base, the lowest often remote on a short subradical peduncle, rarely compound; scales purple with hyaline margins, the male obovate-oblong, obtuse, the female broadly ovate, obtuse or rarely

acute, 3-nerved at base: perigynium olive-colored, triangular-ellipsoidal, turgid, abruptly ending in a cylindrical purple beak with an obliquely cut entire conspicuously hyaline orifice, nerved, divergent, longer than the scale: nutlet olive-colored, triangular-obovoid. — Boott, Ill. i. 21, t. 57. *C. Halseyana*, Dewey, Am. Journ. Sci. xi. 313, t. N, fig. 43.

Swamps near Mendocino City (*Bolander*, n. 4741); also eastward from Massachusetts to Pennsylvania.

63. **C. amplifolia**, Boott. Stem 2½ to 3½ feet high, sharply wing-angled, scabrous: leaves lanceolate, exceeding the stem, 5 to 8 lines broad: bracts 4 or 5 lines broad, the lower two longer than the stem, the lowest sometimes with a sheath ½ to 1 inch long: spikes 5 to 7, cylindrical, the one male purple and peduncled, 2 to 3½ inches long and 2 lines thick, the female ferruginous, 1½ to 3½ inches long and 2 or 3 lines thick, the upper subsessile, the lower peduncled, densely or at base loosely flowered, the lowest occasionally remote on a scabrous peduncle 6 to 14 lines long; scales purple, pale in the middle, membranous, 3-nerved, oblong, the male obtuse or short-cuspidate, the female emarginate, with a longer cusp: perigynium membranous, ferruginous, ellipsoidal, ventricose, glabrous, abruptly beaked, the beak pale below and purple above with an oblique entire hyaline orifice, nerveless, reticulate, divergent, longer and broader than the scale: nutlet triangular-ellipsoidal, chestnut-colored with pale angles, apiculate with the enlarged base of the style. — Hook. Fl. Bor.-Am. ii. 228, t. 226, and Ill. i. 17, t. 48.

In the Sierra Nevada; Mariposa Grove (*Bolander*, n. 5011); Plumas County (*Mrs. Austin*); northward to Oregon and Northern Idaho.

64. **C. Cherokeensis**, Schwein. Stem 1 to 3½ feet high, slender above, smooth: leaves flat, 1½ to 2 lines broad, firm, shorter than or equalling the stem: lower bracts sheathed, sometimes equalling the stem; sheaths 1 to 1½ inches long: spikes 5 to 11, pale, oblong-cylindrical, the 2 or 3 male 8 to 20 lines long and ½ to 1 line thick, the upper largest and rarely female at base, the lowest bracted; female spikes 3 to 9, 6 to 20 lines long and 3 or 4 thick, sometimes male at top, remote, the uppermost often sessile, the rest exsertly peduncled and nodding, simple or the middle spike of 2 or 3 clustered spikelets; lower peduncle 2 or 3 inches long, setaceous, scabrous; scales lanceolate, the male obtuse, the female acute, acuminate or hispidly cuspidate: perigynium membranous, pale straw-color, ovoid or lanceolate, attenuate to a short beak with an obliquely cut entire hyaline orifice, inflated, obsoletely nerved, smooth or sparingly toothed on the upper margins, longer and broader than the scale: nutlet triangular-obovoid with concave sides, loosely invested by the perigynium and half as long, punctate. — Schwein. & Torr. Mon. Cyp. 369, t. 25, fig. 1; Drej. Symb. 25, t. 12; Boott, Ill. i. 31, t. 79. *C. Christyana*, Boott, Bost. Journ. Nat. Hist. v. 115.

On Santa Rosa Creek (*Thurber*); eastward, from Alabama to Texas.

65. **C. Whitneyi**, Olney. Whole plant except the perigynium and scales whitish or glaucous pubescent, the sheaths densely so: stem 1 to 3 feet high, erect, acutely triangular: leaves 3 or 4 lines wide, shorter than the stem: bracts shorter or the lowest a little longer than the stem: spikes 4, rarely 3 or 5, erect, whitish green, the terminal male (rarely 2), oblong or cylindrical, rarely peduncled, the rest female, without sheaths, rather loosely flowered, oblong, contiguous, the lowest peduncled, rarely remote on a very long-exserted peduncle; scales membranous, ovate, cuspidate, ciliate at the apex, 3-nerved, green in the middle: perigynium oval, acutely 3-angled, rostrate with slightly oblique emarginate hyaline orifice, nerved, smooth, longer than or equalling the scale: nutlet ovate, acutely triquetrous, conformed to and nearly as long as the perigynium, dark chestnut-colored. — Proc. Amer. Acad. vii. 394.

In the Sierra Nevada, on dry hillsides; Mariposa to Calaveras Counties, *Brewer*, *Bolander*.

66. **C. Sartwelliana,** Olney, l. c. 396. Stem 2 or 3 feet high, glaucous and the whole plant pubescent, the sheaths densely so: bracts without sheaths, the lower exceeding the stem, or the lowest sometimes sheathed, remote and sterile: spikes 5 or 6 (rarely 4 or 8), chestnut-colored, cylindrical and erect, densely flowered, the terminal one male (or partially female), the rest female (or the upper one male at top), approximate and sessile, subsquarrose, 1 to $1\frac{3}{4}$ inches long and 2 or $2\frac{1}{2}$ lines thick: perigynium chestnut-colored, obovoid, triquetrous, abruptly beaked with an obliquely cut entire orifice, pubescent or densely tomentose, broader and longer or shorter than the chestnut-colored and green-nerved ciliate and pubescent cuspidate-lanceolate or ovate scale: nutlet conformed to the perigynium, triquetrous with the angles ribbed.

In the Yosemite Valley (*Brewer*, n. 1636; *Bolander*, n. 6221); allied to *C. scabrata*, Schwein., and *C. amplifolia*, Boott.

++ ++ *Beak bidentate.*

= *Perigynium smooth.*

67. **C. cinnamomea,** Olney, l. c. Stem $1\frac{1}{2}$ to 2 feet long, erect, with short and narrow scabrous leaves, the rudimentary ones dark purple: bracts sheathing, longer or shorter than the stem, the inner sides of the sheaths ferruginous and scabrous: spikes 3 to 5, erect, 1 to $1\frac{1}{2}$ inches long, the terminal one male, cinnamon-colored, fusiform and long-peduncled, the rest female (the upper rarely male at top), cylindrical, densely flowered, the upper approximate, the lower on long-exserted peduncles, attenuate and loosely flowered at base, the lowest remote: scales cinnamon-colored, green in the middle, membranous, ovate, obtuse, ciliate at top: perigynium elliptical, 3-angled, green, rostellate with the bidentate orifice ciliate within, glabrous, nerved, longer and broader than the scale: nutlet obovate, 3-angled.

In swamps on the Red Mountains, Mendocino County, *Bolander*, n. 6477. Belonging to the *Debiles* group, and agreeing with the eastern *C. Sullivantii*, Boott, in its erect fertile spikes, and with *C. glabra*, Boott, in its sharply 2-toothed prominently nerved and smooth perigynium.

68. **C. Mendocinensis,** Olney, ined. Stem very slender, rather obtusely angled, smooth: leaves 2 to $2\frac{1}{2}$ lines broad, flat, the upper about equalling the stem: bracts clasping and sheathed, the lowest and often the next above exceeding the stem, the uppermost shorter than its spike; sheaths 2 or 3 inches long: spikes 3 or 4, chestnut-colored, linear, erect, 1 to $1\frac{1}{2}$ inches long, the male single, the female loosely flowered, the uppermost sessile, close to the male and often of equal height, the rest approximate or the lowest $\frac{1}{2}$ to 2 inches distant on a capillary mostly enclosed peduncle; scales membranous, chestnut-colored with scabrous green keel and scarious ciliate margins, the male oblong-obovate, obtuse or short-cuspidate, the female oblong or ovate, acute or cuspidate, 1–3-nerved: perigynium triangular-ellipsoidal, rostrate, with bidentate beak and the obtuse hyaline teeth ciliate, smooth, nerved, a little longer than the scale: nutlet triangular-obovoid.

In swamps near Mendocino City, *Bolander*, n. 4701. Named by Mr. Olney, but without description.

69. **C. luzulina,** Olney, l. c. 395. Rootstock creeping: stem 7 to 12 inches high, leafy at base, obtusely angled, smooth: leaves short, 2 to 4 inches long and 3 lines wide, smooth, flat, the lower recurved: bracts shorter than the stem; sheaths $\frac{1}{2}$ to 1 inch long: spikes 4 or 5, rarely 6, dark ferruginous, the upper contiguous, short-oblong and densely flowered, sessile, the terminal one male, the lower female bracted and long-sheathed, the lowest sometimes remote and long-peduncled; scales ovate, obtuse, chestnut-colored with pale green midnerves, ciliate: perigynium oblong-oval or ovate, with bifid serrate beak, glabrous, obsoletely nerved, shorter than the scale: nutlet obovate.

In sphagnous swamps near Mendocino City, *Bolander*, n. 4740. Allied to *C. præcox*, Jacq., of Europe and western Asia.

70. **C. luzulæfolia.** Stem 2 or 3 feet high, curving at top, obtusely angled, smooth, 1- or 2-leaved at or below the middle, many-leaved at base: leaves lance-linear, 4 to 10 inches long and 2 to 4 lines broad, acuminate to a sharp rough triangular apex, much shorter than the stem: bracts sheathed, tapering to a short sharp point, shorter than the peduncles; sheaths 2½ to 3 inches long, enlarging upward: spikes 3 to 6 (usually 6), the male 1 to 3, clavate or obovoid or ellipsoidal, 3 to 9 lines long and 1 to 3 thick, often crowded so closely as to appear a single one, rarely female at top or at bottom, the female 3 to 5, clavate, 6 to 14 lines long and 2 or 2½ thick, the upper often sessile at the base of the male and occasionally overtopping them, the others or all remote on exserted scabrous peduncles 2 to 6 inches long, rather loosely flowered at base, scales purple or pale on the midnerve, oblong or ovate or lanceolate, ciliate, obtuse or acute or roughly cuspidate: perigynium tawny or purple, membranous, compressed-triangular, oval to lanceolate, acuminate to a long cylindrical bidentate beak, the orifice not hyaline, stipitate, often curving outward at top, smooth, slenderly nerved, slightly serrate on the upper margins, longer and broader than the scale: nutlet olive-colored, triangular-obovoid, stipitate, loosely invested by the perigynium and not half its length.

In the Sierra Nevada, at high altitudes, from above Yosemite Valley to Ebbett's Pass and northward, *Brewer*, n. 1701, 2019, 2131; *Bolander*, n. 6210, 6219; *Kellogg*.

71. **C. fulva,** Good., var. **Hornschuchiana,** Boott. Stem slender, 1 to 2½ feet high, smooth: leaves flat, a line broad, much shorter than the stem: bracts sheathing, the lower exceeding their spikes; sheaths ½ to 1 inch long: spikes 3 to 6, chestnut-colored, the male 1 or rarely 2, cylindrical, 6 to 9 lines long, the female oblong, 3 to 6 lines long, densely flowered, the upper usually close to the male and often male at top, the rest approximate or remote on short peduncles or the lower peduncle longer (an inch long); scales chestnut-colored with hyaline margins, ovate, obtuse or rarely acute: perigynium membranous, obtusely and unequally triangular-ellipsoidal, with a scabrous hyaline-toothed beak, smooth, nerved, divergent, longer than the scale: nutlet chestnut-colored, triangular-obovoid. — Ill. iv. 137, t. 443. *C. Hornschuchiana*, Hoppe. *C. speirostachya*, Smith; Eng. Bot. t. 2770.

In the Yosemite Valley, at Inspiration Rocks, and in the Mariposa Grove (*Bolander*, n. 4905, 4995); also in Newfoundland, and in Europe.

= = *Perigynium hirsute.*

72. **C. filiformis,** Linn., var. **latifolia,** Boeckeler. Stoloniferous: stem 1 to 2½ feet high: leaves flat, 1 or 2 lines broad, often exceeding the stem; lower sheaths fibrous-reticulate, scabrous on the outer sides: bracts without sheaths or the lowest with a sheath 2 inches long or less, those of the female spikes exceeding the stem: spikes 3 or 4 (rarely 6), purple, the male 1 to 4, linear, sometimes female at top, the upper the largest, 16 to 26 lines long, more or less pedunculate, the lower sessile and the lowest setaceously bracted; female spikes 2 to 4, oblong or cylindrical, ½ to 2 inches long and 3 or 4 lines thick, often male at top, densely flowered, remote and sessile, or the lowest peduncled, loosely flowered at base, and rarely compound; peduncles scabrous, 2 lines to 2 inches long; scales purple, pale in the middle, lanceolate to ovate or oblong, acute, ciliate at top or roughly cuspidate, 1–3-nerved: perigynium olive-colored, coriaceous and hispid, ellipsoidal or ovoid, obtusely angled, turgid, abruptly ending in a short bicuspidate beak with divergent scabrous teeth, nerved, broader and usually shorter than the scale: nutlet chestnut-colored, triangular-ellipsoidal or obovoid, stipitate: style often contorted. — Linnæa, xli. 309. *C. lanuginosa*, Michx.; Boott, Ill. i. 48, t. 129. *C. pellita*, Muhl.; Schk. Car. 84, fig. 149, 150.

Var. **æmatorhyncha.** Spikes 4, cylindrical, the male 2, the others female, contiguous; lower male scales obtuse, rounded, the upper apiculate, the lower female lanceolate and the upper ovate, acute: perigynium ovate, emarginate-bidentate, pale

at base, the beak purple, very rough with long hairs, shorter or a little longer than the scale: nutlet oval. — *C. œmatorhyncha*, Desv.; Gay, Fl. Chil. vi. 224, t. 73, fig. 22; Boott, Ill. i. 67, t. 183, fig. 1.

In the Sierra Nevada, Yosemite Valley and Mariposa Grove (*Brewer, Bolander*); abundant in Mono Valley (*Brewer*, n. 1814), and also collected in alkaline soil in Tulare plain, *Brewer*, n. 1592. Both the typical form (which is also European) and the variety *latifolia* are frequent from Arctic America to the northern Atlantic States, the variety on the west ranging southward to New Mexico, Utah, Nevada and California. Var. *œmatorhyncha* has been collected in the Mariposa Grove, and in the Jordan Valley, Utah, and is also Chilian.

73. **C. gynodynama**, Olney. Cespitose: stems 10 to 18 inches high, leafy and with long sheaths: leaves flat, ciliate, much shorter than the stem: bracts involute, ciliate, the lowest nearly equalling or shorter than the stem: spikes 4 or 5, erect, cylindrical, ferruginous, the terminal one male, female at the top or often in the middle or at base, the rest female, the upper far overtopping the male, the lowest remote, long-sheathed, peduncled; scales ovate, membranous, ciliate, mucronate or acute, chestnut-colored, pale in the middle: perigynium elliptical, olive-colored, the purple summit covered with long white hairs, glabrous at base, the beak bifid, slightly nerved at base, broader and shorter than the scale: nutlet obovate, olive-colored. — Proc. Amer. Acad. vii. 394.

In swamps near Mendocino City, *Bolander*, n. 4700.

+ + + *Perigynium large and inflated, the elongated beak mostly deeply bicuspidate.*

74. **C. trichocarpa**, Muhl., var. **imberbis**, Carey. Stem 2 or 3 feet high, smooth: leaves 1 to 3 lines broad, the lower sheaths fibrous-reticulate: bracts of the female spikes foliaceous, exceeding the stem, all or only the lower with sheaths 2 to 8 or rarely 16 lines long: spikes 5 to 12, cylindrical, erect, alternate or the upper ones crowded, the male 3 to 9, ferruginous, linear, 4 to 18 lines long and 1 or 1½ thick, the lowest 1 or 2 bracteate; female spikes 2 to 4, 1½ to 2½ inches long and 4 to 6 lines thick, approximate or remote, densely or loosely flowered and attenuate at base, the upper rarely male at top, the lower on peduncles ½ to 2 inches long; scales purple with green midnerves and broad hyaline margins, ovate or lanceolate, acute or hispidly cuspidate: perigynium smooth, ovoid or lanceolate, tapering to a long deeply bicuspidate beak with the scabrous lanceolate lobes membranous on the margins, strongly nerved, longer than the scale: nutlet triangular-ovoid, olive-colored. — Gray's Manual, 597; Boott, Ill. i. 58, t. 152, the typical form, with pubescent perigynium and very scabrous stem.

In swamps at Cahto, Long Valley, Mendocino County, *Bolander*, n. 4689. In the Atlantic States from Canada to Georgia, and westward from the Saskatchewan to Colorado and Utah.

75. **C. monile**, Tuckerman. Stem rather slender, 1 to 2½ feet high, sharply angled, scabrous: leaves 1 or 2 lines broad, flat, shorter than the stem, the lower sheaths sparingly fibrous-reticulate: bracts longer than the stem, the lowest rarely with sheaths 2 to 4 lines long: spikes 3 to 6, elongated, cylindrical, the male 2 to 4 (usually 3), 1 to 2½ inches long and 1 or 1½ lines thick, sometimes female at top, the lowest setaceously bracted; female spikes 2, rarely 1 or 3, terete, 1¼ to 2½ inches long and 8 lines thick, remote, the upper rarely male at top, the lowest sometimes attenuate and loosely flowered at base and nodding upon a peduncle 1½ inches long or less; scales purple, pale in the middle with hyaline margins, ovate or lanceolate, acuminate, 1 – 3-nerved: perigynium inflated, globular-ovoid, abruptly contracted to a cylindrical bidentate beak, glabrous, or the beak and lobes serrate, 8 – 10-nerved, shining, longer or shorter and broader than the scale: nutlet chestnut-colored, triangular-obovoid. — Boott, Ill. i. 28, t. 72. *C. Vaseyi*, Dewey, Am. Journ. Sci. 2 ser. xxix. 347, a form with the teeth of the beak serrate.

Ostrander's Meadow, *Bolander*, n. 6211. From subarctic British America to the northern Atlantic States. A variety of *C. vesicaria* according to Boeckeler.

76. **C. vesicaria,** Linn. Rootstock creeping: stem 1 to 3½ feet high, sharply angled, scabrous: leaves 2 or 3 lines broad, the upper exceeding the stem; sheaths fibrous-reticulate: bracts exceeding the stem, the lowest rarely with sheaths 2 to 9 lines long: spikes 3 to 8, the male 2 or 3, contiguous, 1 to 1¾ inches long and 1 to 1½ lines thick, the lowest setaceously bracted; female spikes 2 or 3, rarely 4, an inch or two long, 4 to 6 lines thick, oblong or cylindrical, approximate and densely flowered or the lowest remote and loosely flowered at base, the upper sessile, the lower on nodding peduncles ¼ to 1½ inches long; scales membranous, purple, pale in the middle with hyaline margins, the male linear-oblong, broadest near the top, acute, the female ovate or lanceolate, acute or acuminate, not awned: perigynium straw-colored, ovoid-conical or subglobose-ovoid, obtusely angled, gradually tapering to an obliquely cut bidentate beak, glabrous, shining, nerved, ascending, longer and broader than the scale: nutlet chestnut-colored, triangular-obovoid, punctate: style contorted. — Schk. Car. fig. 106.

Var. β, Boott. Leaves and bracts much longer: perigynium conical, the beak very long and teeth minute: scales ciliate at top. — Ill. iv. 162, t. 537.

Var. γ. Leaves and bracts much exceeding the stem: male spikes 2, rarely 3, ½ to 1¾ inches long, the female 1 to 3, ¾ to 1¼ inches long, the lowest short-peduncled; scales purple, broadly hyaline on the upper margins and at the summit, obtuse, the female ovate: perigynium purplish at top, broadly ovoid, abruptly contracted to a longer or shorter minutely bidentate beak, the length of the scale: stigmas very rarely 2.

The typical form, of Europe and Kamtschatka, rarely found in North America, has been collected in the Yosemite Valley (*Brewer*, n. 1654; *Bolander*, n. 6200), and in Oregon. The first variety, found by *Lyall* on Saturna Island, British Columbia, occurs also at Tomales Bay (*Bolander*, n. 2303); and the second at Soda Springs on the Tuolumne, *Brewer*, n. 1781.

77. **C. utriculata,** Boott. Stoloniferous, glaucous: stem stout, spongy at base, 2 to 3 feet high or more, smooth below the spikes: leaves closely nodose-reticulated, 2 to 6 lines broad, much exceeding the stem, carinate, the margins recurved: bracts much longer than the stem, the lowest sometimes with sheaths ¼ to 1 inch long: male spikes 2 to 5, linear, 1 to 4½ inches long and a line thick, often female at top, the lowest bracted; the female 2 to 6, cylindrical, obtuse, ¾ to 7½ inches long and 4 to 8 lines thick, approximate or remote, the upper sessile, often conspicuously male above and rarely at bottom, densely flowered, the lowest pedunculed, often attenuate and loosely flowered at base, sometimes compound; peduncles 8 lines to 10 inches long; scales membranous, purple, pale in the middle with hyaline margins, oblong or lanceolate, acute or roughly awned: perigynium straw-colored, shining, smooth, ellipsoidal, ovoid or globose-ovoid, inflated, gradually or more or less abruptly contracted to a cylindrical bicuspidate beak, spreading or squarrose, nerved, broader and mostly longer than the scale: nutlet triangular-obovoid, olive-colored: style contorted. — Hook. Fl. Bor.-Am. ii. 221, and Ill. i. 14, t. 39.

In the Sierra Nevada, frequent, from Fresno County northward; eastward, from subarctic British America to the northern Atlantic States, Colorado and Utah. Boeckeler (Linnæa, xli. 318) refers to this species *C. lævirostris*, Fries (Kunze, Suppl. i. 194, t. 49), of northern Europe and Siberia, which is similar in most of its characters, but the bracts are described and figured as about equalling the stem, and the scales as acute and not as awned.

78. **C. pseudocyperus,** Linn., var. **comosa,** Boott. Stem 1½ to 2½ feet high, stout, very scabrous on the sharp angles: leaves rigid, nodose, 2½ to 5 lines broad, tapering to a long slender triangular apex, the upper exceeding the stem: bracts of the female spikes much exceeding the stem, the lowest sometimes with a sheath 1 to 3½ inches long, usually sheathless: spikes 4 to 6, densely flowered, the uppermost male, linear, 1 to 3½ inches long, often female at top or sometimes almost wholly so; female spikes 1¾ to 3 inches long and 4 to 7 lines thick, stout, cylindrical, rarely male at top and compound at bottom, drooping or pendulous, approximate or the lowest remote; peduncles 2 to 18 lines long, or the lowest 4 to 10 inches;

scales pale or ferruginous, attenuate to a long hispid awn, the male linear-lanceolate, the female lanceolate or oblong, shorter or with the awn longer than the perigynium: perigynium coriaceous, pale olive, ovate or lanceolate, unequally 3-angled, stipitate, attenuate to a very long slender bicuspidate beak (the smooth subulate lobes recurved, nearly a line long), strongly nerved, divergent or recurved: nutlet triangular-ellipsoidal or obovoid, chestnut-colored. — Ill. iv. 141. *C. comosa*, Boott, Ill. i. 14, t. 38.

Swamps near San Francisco (*Bolander*, n. 2301); Oregon (*Howell*), and in the Atlantic States from New England to Georgia and Louisiana. The typical European form occurs eastward from the Saskatchewan to New England, and other forms prevail in South America, Australia, and southern Asia.

Order CXIX. GRAMINEÆ. (By Dr. George Thurber.)

Flowers hypogynous, perfect or unisexual, in 1–several-flowered spikelets consisting of small green or more or less scarious bracts imbricated in two ranks, the lower and exterior pair in each spikelet called *glumes*. These are close together upon the rhachis of the spikelet, one lower than and more or less embracing the other (*lower* and *upper glume*). The proper flowers are inclosed in usually two bracts (*paleæ* or *palets*), which together with their contents are termed a *floret;* this is stalked or sessile within the glumes, and persistent or deciduous. The *lower palet*, usually quite different from the glumes in size, shape, texture and number of nerves, is herbaceous, membranaceous, chartaceous, or coriaceous, or even indurated in fruit, and frequently awned. The *upper palet*, usually wrapped within the lower, from which it differs in texture and size, being often very delicate or hyaline, is 2-nerved, mostly with infolded margins, usually smaller, sometimes much reduced or obsolete. Opposite the upper palet are two (rarely three or sometimes wanting) very small hyaline scales (*perianth* of some, also *squamulæ* or *lodiculæ*), rarely longer than the ovary. Stamens 3 (rarely 2 or 1, or 6 or more), with very slender filaments and linear anthers, without prominent connective, versatile and pendulous; pollen sometimes purplish or reddish, mostly yellow. Ovary sometimes stipitate, smooth or hairy above, with one erect anatropous ovule. Styles 2 (rarely 3), distinct, or partly united below, stigmatic above with simple or branched hairs. Fruit erect, free, or more or less adherent to the inclosing palets, the seed completely filling the pericarp and adherent to it (a *caryopsis*), or rarely quite free from and loosely surrounded by it (forming a *utricle*). Seed erect, longitudinally furrowed, with a very thin adherent testa. Embryo small, nearly globular, seated in a pit at the inner side of the base of the albumen, which is farinaceous, or between farinaceous and horny. — Tufted annual or perennial herbs, with terete usually hollow culms, simple or branching from the solid nodes, sometimes stoloniferous or rhizomatous. Petioles sheathing the culm more or less closely, the sheath split usually its whole length on the side opposite to the mostly long and narrow, often convolute-filiform blade; at the base of the blade is a more or less conspicuous scarious *ligule* (*stipule* of some), sometimes appearing only as a cartilaginous ring or as a fringe of hairs. Inflorescence very various, spicate or capitate, racemose or paniculate; in a few genera, as *Cenchrus*, *Coix*, etc., the spikelets are surrounded by a hard bony involucre, formed by a peculiar development of some portion of the inflorescence.

Grasses are widely distributed from equatorial to arctic regions, some genera especially abundant in the tropics, but the majority belonging to the temperate zones. In the number of individuals they probably exceed all other flowering plants, while in the number of species the family stands third, the first and second places belonging to *Compositæ* and *Leguminosæ*. In usefulness to man they easily take the first rank, as they are at the foundation of all agriculture, their herbage affording the larger share of the food of animals, while their seeds supply, in the cereal grains, the chief food of the world. Rice, Durra, Maize, Wheat, Rye, Oats, Barley, and Sugar-Cane, need only to be mentioned to show the economical importance of the family. It is a singular fact that the most useful of the family, those which furnish the cereal grains, are none of them known with certainty in the wild state, even their native countries being in doubt. But few grasses present marked properties. *Anthoxanthum*, *Hierochloe*, and a few others, have a pleasant Vanilla-like odor, due to a principle like *coumarin*. Some oriental species of *Andropogon* afford in their foliage the oils of Lemon-Grass, Citronella, and Geranium, and from the roots of another species is obtained the perfume "Vettiver." The rhizomes of *Triticum repens* and of *Cynodon Dactylon* have long had a reputation for usefulness in diseases of the bladder. The many uses which the stems of species of *Bambusa*, the Bamboos, are made to serve in China and other eastern countries give them a high rank among the useful grasses. In ornamental gardening, besides furnishing the carpet of verdure without which our gardens would lose much of their attractiveness, grasses play an important part. From the humble *Festuca glauca*, the striking blue foliage of which is used for edgings, up to the stately *Gynerium argenteum*, the Pampas-Grass, the list of ornamental species and varieties is a long one.

In describing the structure of the spikelets, both Bentham and Hooker make use of different terms from those here given. They designate the *glumes* as "empty glumes," and the *lower palet* as the "flowering glume," while they have but a single "palet," which is our *upper palet*. The usual terminology is here followed, as the one universally taught in our text-books, and as not involving any theoretical views of the structure of the flowers. In the grouping of the genera of this immense family into subgenera, or into tribes and subtribes, botanists differ widely, according to the prominence given by the authors to particular characters. The arrangement here presented is not made to express any views as to the relationship of the genera, but solely with the object of leading the student to the genus by the most direct path.

TRIBE I. PANICACEÆ. Spikelet articulated with the pedicel below the glumes, mostly 2-flowered: one flower fertile; the staminate or barren floret, when present, below it.

Subtribe I. PANICEÆ. Spikelets of one terminal perfect floret with an imperfect (staminate or neutral) one below it, the latter often reduced to a single palet; sometimes appearing as if 1-flowered by the suppression of the lower glume and the upper palet of the neutral floret. Grain inclosed in the coriaceous or chartaceous palets of the perfect floret.

* Spikelets apparently 1-flowered by absence of the lower glume, the palet of the neutral floret taking its place.

1. **Paspalum.** Spikelets plano-convex, on one side of a flattened rhachis.

* * Spikelets 1½- or 2-flowered: lower floret staminate or neuter, of 1 or 2 palets.

2. **Panicum.** Spikelets without an involucre. Lower glume usually minute.
3. **Setaria.** Spikelets with an involucre of bristles proceeding from the pedicels.
4. **Cenchrus.** Spikelets inclosed, 1 to 3 together, in a hard bristly or spiny bur-like involucre.

Subtribe II. ANDROPOGONEÆ. Spikelets in pairs, very dissimilar, one rudimentary. Palets of the fertile floret scarious, thinner than the indurated glumes.

5. **Ischæmum.** Spikelets on one side of a single spike.

TRIBE II. PHALARIDEÆ. Spikelets not articulated below the glumes, of one terminal perfect flower, or with two male or neutral or rudimentary florets below the perfect one. Spikelets laterally compressed. Glumes sometimes united below.

* Glumes wanting: inflorescence panicled.

6. **Leersia.** Spikelets much flattened. Palets rigid. Stamens 1 to 3 or 6.

* * Glumes present.

+ Spikelets 1-flowered, densely spiked: glumes equal, boat-shaped, strongly keeled.

7. **Alopecurus.** Glumes united at base. Lower palet awned, upper wanting.
8. **Phleum.** Glumes distinct. Lower palet awnless, upper present.

+ + Spikelets 1 – 2-flowered, panicled.

9. **Beckmannia.** Spikelets (ours 1-flowered) crowded in two rows upon the branches.

+ + + Spikelets 3-flowered, the lateral staminate or neutral: plant sweet-scented.

10. **Hierochloe.** Lateral florets staminate. Panicle loose.
11. **Anthoxanthum.** Lateral florets neutral, of a single awned hairy palet.

+ + + + Spikelets 3-flowered, the lateral reduced to a rudiment, the fertile coriaceous.

12. **Phalaris.** Glumes boat-shaped.

Tribe III. POACEÆ. Spikelet not articulated below the glumes, its rhachis articulated above the glumes or continuous. Spikelets 1-many-flowered. Lowest flower (with few exceptions) perfect; occasionally monœcious or diœcious; terminal floret never more perfect than those below it. Axis of spikelet often terminated by an imperfect floret, which is frequently reduced to a bristle or small point.

Subtribe I. AGROSTIDEÆ. Spikelets 1-flowered, perfect, occasionally with a rudiment of a second floret as an abortive pedicel. Callus, when manifest, often bearded. Awn, when present, terminal or dorsal, not twisted. Lower palet usually thin. Inflorescence in open panicles, or contracted and spike-like.

* Callus not manifest; floret sessile within the glumes.

+ Spikelets of two kinds, in pairs or threes.

13. **Ægopogon.** One spikelet in a cluster perfect, the others staminate or neuter.

+ + Spikelets alike and perfect.

14. **Coleanthus.** Spikelets in small umbellate clusters.

15. **Vilfa.** Spikelets in contracted panicles. Seed adherent to the pericarp (caryopsis).

16. **Sporobolus.** Spikelets in usually open panicles. Seed free from pericarp (utricle).

* * Callus present, the floret raised within the glumes on a short rounded or stalk-like base.

+ Glumes long-awned.

17. **Polypogon.** Glumes much longer than the floret.

+ + Glumes awnless (except in one *Agrostis*).

18. **Agrostis.** Lower glume slightly longer and exceeding the very thin blunt palets, the lower of which is 3-5-nerved and sometimes awned on the back, the upper often wanting.

19. **Gastridium.** Glumes with a shining ventricose base. Inflorescence spike-like.

20. **Cinna.** Lower glume shorter. Floret distinctly stipitate. Lower palet short-awned below the tip or awnless.

21. **Muhlenbergia.** Glumes variable, sometimes minute. Lower palet awned from the apex. Floret mostly bearded at base and early deciduous.

+ + + Glumes longer than the floret, which has a more or less conspicuous tuft of hairs at base.

22. **Vaseya.** Awn terminal. No rudiment of a second flower.

23. **Calamagrostis.** Awn from below the tip of palet. Rudiment present and mostly bearded.

Subtribe II. STIPACEÆ. Spikelets strictly 1-flowered. Floret with a sharp-pointed callus, deciduous. Lower palet involving the upper and the grain, coriaceous and indurated in fruit and terminated by a (usually long) simple or triple awn.

24. **Eriocoma.** Awn simple, short, angled, caducous. Floret clothed with long silky hairs.

25. **Stipa.** Awn simple, long, twisted below.

26. **Aristida.** Awn triple, continuous or (rarely) articulated with the palet.

Subtribe III. CHLORIDEÆ. Spikelets 1-several-flowered (one or more of the upper florets imperfect or rudimentary), in simple 1-sided spikes upon a jointless rhachis; the spikes racemed or digitate.

* Spikelets 1-flowered.

27. **Spartina.** Spikelets much flattened laterally, in two rows upon one side of a 3-cornered rhachis. Spikes racemed.

* * Spikelets 2-flowered or more, one floret perfect, with two or more imperfect or neutral flowers above it.

28. **Bouteloua.** Lower palet 3-cleft and 3-awned at apex. Imperfect flowers often reduced to three awns.

29. **Cynodon.** Floret and rudiment awnless. Spikelets in digitate spikes.

* * * Spikelets 3-several-flowered with more than one perfect floret.

30. **Leptochloa.** Spikes slender, racemed.

Subtribe IV. PAPPOPHOREÆ. Spikelets 1-many-flowered, perfect or staminate, in a spike-like panicle. Glumes many- (3-9-) nerved, entire or 2-cleft, with the nerves often excurrent as setæ. Palets entire or 2-toothed, often awned.

31. **Pleuraphis.** Spikelets in threes at each joint of the rhachis, subtended by a hairy tuft, the middle one perfect, the others staminate.

Subtribe V. AVENACEÆ. Spikelets panicled, 2-several-flowered, the rhachis, often bearded, prolonged into an imperfect rudiment. Glumes mostly equalling or exceeding the flowers.

Lower palet usually bearing on the back or between its teeth a twisted bent or straight awn. Ovary sometimes hairy at top.

* Spikelets with two or more lower florets perfect.

32. **Danthonia**. Spikelets several-flowered. Lower palet rounded on the back. Awn formed from the three united middle nerves, proceeding from the cleft at the apex.
33. **Avena**. Spikelet 2–several-flowered. Lower palet rounded on the back, 2-toothed at tip. Awn from the midnerve only.
34. **Trisetum**. Spikelet 2–several-flowered. Lower palet compressed and keeled, 2-toothed or 2-pointed at apex. Awn from near the cleft, from the midnerve only.
35. **Aira**. Spikelet 2-flowered, with or without a rudiment of a third flower. Lower floret awned from near the base.

* * Spikelets 2-flowered, with one flower staminate.

36. **Arrhenatherum**. Lower flower staminate, awned; upper perfect and usually awnless.
37. **Holcus**. Lower flower perfect, awnless; upper staminate and awned.

Subtribe VI. FESTUCACEÆ. Spikelets panicled, several–(rarely 2–) many-flowered, the rhachis usually prolonged and bearing an imperfect floret or a bristle. Palets pointless, or the lower tipped with a straight and (except in *Bromus*) terminal awn.

* Abortive flowers of several empty palets in a separate spikelet from the perfect ones.

38. **Lamarckia**. Panicle unilateral, spike-like.

* * Abortive or staminate flowers in the same spikelet with the perfect ones.

\+ Lower 1 or 2 florets staminate or neutral.

39. **Phragmites**. Spikelets in an ample panicle, with 1 staminate floret below 2 to 4 perfect ones; rhachis bearded with long hairs.
40. **Eremochloe**. Spikelets in a short nearly simple panicle, with 2 neutral florets below one fertile one, beyond which is a triple hairy rudiment.

\+ \+ Lowest flowers all perfect: grain not adherent to the palets: joints of the rhachis bearded only in *Tricuspis*.

41. **Tricuspis**. Lower palet bearded on the 3 nerves, one or all of which project into short awns.

\+\+ Lower palet pointed, awned or acute, the nerves, when present, running into the point.

42. **Dactylis**. Glumes and lower palets herbaceous, awn-pointed, compressed-keeled. Spikelets in dense 1-sided clusters in a 1-sided panicle.
43. **Kœleria**. Glumes and lower palet membranous, keeled, acute or mucronate. Panicle contracted, spike-like.

\+\+ \+\+ Lower palet pointless and awnless (except in *Melica*), blunt, the nerves parallel.

= Lower glume 1-nerved, the upper 3-nerved.

44. **Eatonia**. Glumes very unlike, the upper much broader than the linear lower one and wrapped around the flowers.

= = One or both glumes 5-nerved or more.

45. **Melica**. Lower palet flattish on the back, 7-nerved or more, membranous at tip. Fertile flowers 1 to 3, the upper enwrapping the 1 to 3 imperfect ones.
46. **Distichlis**. Lower palet much compressed laterally, many-nerved, somewhat coriaceous. Flowers diœcious.

= = = Glumes 1–3-nerved.

47. **Lophochlæna**. Lower palet prominently 7-nerved, its midnerve produced as an awn at the 2-toothed or truncate scarious apex. Upper palet appendaged on the nerves. Glumes much shorter than the florets.
48. **Glyceria**. Lower palet rounded on the back, the 5 to 7 nerves not reaching the scarious mostly blunt apex. Spikelets many-flowered, deciduous at maturity, the rhachis breaking up into joints.
49. **Atropis**. Lower palet chartaceous, convex or rounded on the back, faintly 5-nerved, the nerves not reaching the obtuse subdenticulate or mucronulate apex.
50. **Poa**. Lower palet laterally compressed, mostly keeled, 5-nerved, membranous, the margins or nerves below with cobwebby hairs or pubescent; upper palet falling with the lower.
51. **Eragrostis**. Lower palet 3-nerved, keeled, deciduous, leaving the persistent upper one. Spikelet flattened, usually many-flowered.
52. **Stenochloa**. Glumes long and narrow, much exceeding the 2 or 3 deciduous florets. Lower palet 3-nerved.

\+ \+ Lowest flowers all perfect: grain adherent to the palets.

53. **Briza**. Lower palet rounded, very obtuse, pointless, many-nerved, becoming ventricose. Spikelets somewhat heart-shaped.

54. **Festuca.** Lower palet rounded on the back, few-nerved, pointed or awned at tip. Spikelets flattish. Ovary mostly smooth.
55. **Bromus.** Lower palet convex or keeled on the back, 5–9-nerved, mostly awned below the 2-cleft tip. Ovary pubescent, obtuse.
56. **Ceratochloa.** Lower palet much compressed, entire, pointed or awned. Spikelets flattened. Ovary pubescent, with three horns at top.

Subtribe VII. HORDEACEÆ. Spikelets 1–several-flowered, sessile in alternate notches on the opposite sides of a zigzag rhachis, either solitary or several together. Glumes entire, awned or unawned.

* Spikelet single (2 in one *Lepturus*) at each joint of the rhachis.

57. **Lepturus.** Spikelet single, 1-flowered, almost imbedded in the notches of the slender rhachis. Slender spike usually solitary, or with a second pedicelled spikelet.
58. **Lolium.** Spikelets many-flowered, placed with the edge next to the rhachis. Glume 1 (except in the terminal spikelet), the inner one next to the rhachis lacking.
59. **Triticum.** Spikes 3–several-flowered, placed flatwise on the rhachis, both glumes present, standing right and left.

* * Spikelets 2 or more at each joint of the rhachis.

\+ Glumes anterior, forming a sort of involucre for the cluster of spikelets.

60. **Hordeum.** Spikelets 1-flowered, in threes at each joint; lateral spikelets usually sterile.
61. **Elymus.** Spikelets 1–several-flowered, 2 to 4 at each joint, all perfect and similar.

\+ \+ Glumes none, or 1 or 2 awn-like rudiments in their place.

62. **Gymnostichum.** Spikelets few-flowered, somewhat pedicelled, 1 to 3 at each joint.

1. PASPALUM, Linn. PASPALUM.

Spikes or racemes solitary, either few and digitate or many and panicled. Spikelets in two to four rows upon one side of a flattened or filiform jointless rhachis, jointed upon their short pedicels, plano-convex, awnless, apparently one-flowered. Glumes two, nearly equal, few-nerved. Palets two, roundish or ovate, coriaceous, the outer large, convex and enclosing the smaller flattened upper one, rarely mucronate or with a few minute hairs at the apex. Scales 2, wedge-shaped or quadrate, emarginate. Stamens 3. Ovary oblong, smooth: styles elongated; stigmas hairy. Grain enclosed in the hardened palets.

A large mostly tropical genus of no agricultural value, of which 20 or more species occur in the older States, though but one has thus far been detected on the Pacific Coast. The spikelets are apparently one-flowered, but they are properly two-flowered with the lower glume suppressed, while what appears as the lower glume is the lower palet of a lower floret, the upper palet of which is wanting. In some species the lower glume is present as a minute scale.

1. **P. distichum,** Linn. Culms from a strong perennial widely creeping rootstock, 6 to 12 inches high, and clothed below by the somewhat crowded sheaths: leaves flat, linear-lanceolate, 2 to 3 inches long, glaucous, rough above and with the sheaths smooth or hairy: spikes two (rarely three or four), spreading, one sessile and the other pedicelled, 1 to 1½ inches long, densely flowered; spikelets in two rows, ovate, acute, 1½ lines long: glumes 3-nerved, more or less pubescent. — *P. vaginatum,* Swartz; Trin. Sp. Gram. i, t. 120; Doell, Fl. Bras. ii². 75. *Panicum polyrhizum,* Presl, Rel. Hænk. i. 296.

San Diego (*Parry*); Los Angeles (*Veriu*); Clear Lake (*Bolander*); also in Oregon and common in the Southern Atlantic States. Widely distributed in both the Old and New World and in Australia. The appearance of the plant is greatly modified by the locality. The rootstock, sometimes as large as the little finger, often runs just below the surface for many feet; in sands, the ascending stems are clothed with sharp-pointed scales (undeveloped sheaths), and have only a few proper leaves at the top. In some cases the elongation of the stem is arrested, probably by being injured by some insect, and only the sheath is produced as a broad scale. When this occurs at the base of the stem, the rootstock appears as if it bore scaly bulbs, like those of some small lily. It is oftener near the top of the stem, which looks as if it were terminated by a small cone.

A fragment of a Paspalum in the Torrey herbarium is marked "709, Coulter, California." There is probably an error as to the locality, as no other collector has met with it.

2. PANICUM, Linn. Panic-Grass.

Panicle various, either loose and spreading or close and spike-like, sometimes with the inflorescence crowded upon one side of a narrow rhachis. Spikelets without involucre or bristles at base, 1½- or 2-flowered, articulated with their pedicels. Glumes two, herbaceous, the lower smaller, often minute and sometimes wanting, the upper equalling the perfect floret. Lower floret staminate or neutral, often reduced to a single (lower) palet resembling the upper glume; its upper palet, when present, very thin and hyaline: upper floret coriaceous or cartilaginous, usually closed and mostly flattened parallel with the glumes, awnless; lower palet enclosing the upper. Scales 2, fleshy, truncate. Ovary smooth, oblong: stigmas usually purple and longer than the styles. Grain compressed, plano-convex, inclosed in the hardened palets.

A vast largely tropical genus, over 800 species being recorded, of which it is estimated that some 500 are really distinct. The flora of California differs remarkably from that of the Atlantic States in the small number of native Panicums, as, while 35 to 40 species are found on the eastern coast, not more than four can be regarded as natives of the western. But few of the genus are useful to man; the common Millet, *P. miliaceum*, was formerly more cultivated than at present, both for its seeds and as a forage crop. Some botanists arrange the species here enumerated in three different genera, as indicated by the following sections.

§ 1. *Spikelets in pairs, one sessile, the other pedicelled, crowded on one side of simple flattened branches, which are digitately clustered at the top of the culm: lower floret neutral, of a single palet.* — Digitaria.

1. **P. sanguinale**, Linn. (Crab-Grass or Finger-Grass.) Culms 1 to 2 feet long, usually spreading and creeping at base, then ascending or erect: leaves and sheaths smooth or hairy: spikes four to six or more, 2 to 4 inches long; spikelets 1 to 1½ lines long: lower glume very minute, the upper glume half the length of the floret. — Torr. Fl. N. York, ii. 423, t. 146. *Digitaria sanguinalis*, Scop.; Reichenb. Icon. Fl. Germ. i. 68, t. 187. *P. fimbriatum*, Presl in Rel. Hænk. i. 298.

Introduced; a common annual weed in most countries, appearing late in the season and by means of the roots at the lower nodes taking such a firm hold of the soil as to be very difficult to remove. The spikes, and sometimes more or less of the plant, are purple. This is undoubtedly the plant collected by Haenke. In the Southern States it is much valued for both hay and pasturage. It makes a very light hay, but affords a much-esteemed pasturage in midsummer.

P. glabrum, Linn., the Smooth Crab-grass, of Europe and Asia, is very common in the Atlantic States and is likely to be found here as a weed. It may be distinguished by having its upper glume as long as the floret, while the spikes are shorter, fewer, and less regularly digitate.

§ 2. *Spikelets disposed in panicles, scattered, awnless.* — Panicum proper.

* *Panicle elongated, racemose: spikelets small, short-pedicelled.*

2. **P. agrostoides**, Spreng. Culm from a perennial root, erect, about 2 feet high, more or less flattened: leaves long and with the sheaths smooth: panicle pyramidal, 4 to 8 inches long, often one-sided and frequently purplish; spikelets crowded and one-sided upon the branches, about a line long, ovate, acute: lower glume half the length of the neutral floret; upper glume 5-nerved: perfect floret shorter than the upper glume, smooth except a few minute hairs at the apex. — Trin. Spec. Gram. iii, t. 261; Torr. Fl. N. York, ii. 429, t. 148.

This, which is a common species in the Atlantic States, is given as a native from its occurrence in the collection made by *Dr. Pickering* and labelled "Valley of the Sacramento."

* *Panicle diffuse and spreading.*

+ *Spikelets pointed.*

3. **P. capillare**, Linn. (Old-Witch Grass.) Culms often branching at base and forming large tufts 1 to 2 feet high, from an annual root: sheaths, and usually the leaves, very hairy: panicle half the length of the culm, very open, its long

slender branches solitary or in pairs, at first erect, then spreading and when old often reflexed; spikelets 1½ lines long, ovoid to narrowly oblong, pointed and often purplish, scattered, on mostly much longer pedicels: neutral floret of a single palet, twice the length of the acute 1-nerved lower glume; upper glume 5-nerved, pointed, nearly a half longer than the somewhat obtuse perfect flower. — Reichenb. l. c., t. 192.

Distributed throughout the State and the adjoining States and Territories. This is an abundant grass, mostly in sandy soil, from the Atlantic to the Pacific, and varies considerably at the East, but the western specimens are more robust and the branches of the panicle stronger than in the eastern plant, while the spikelets are somewhat longer on shorter pedicels; but there are no permanent differences. Of no agricultural value; indeed it is said that animals will not touch it. The dry panicles break off in autumn, and are blown about by the winds, often collecting in great heaps in fence-corners, etc.

4. **P. Urvilleanum,** Kunth. Culms perennial, 12 to 20 inches high and, like the whole plant, clothed with whitish hairs: leaves rigid, 12 to 18 inches long, 3 lines wide at the flat base, convolute above and ending in a very long tapering point: panicle 6 to 10 inches long, open, the not numerous branches solitary or in pairs, bearing towards their ends a few very hairy large spikelets, which are 2 to 3 lines long, ovate, acute: lower glume 7-nerved, two-thirds the length of the 15-nerved upper one, the nerves in both distinct and greenish: sterile floret staminate, with two palets, the lower 15-nerved; perfect floret oblong, smooth except a fringe of long silky hairs upon the margins. — Rev. Gram. t. 115; Brongn. Voy. Coquille, Phan. 117, t. 9.

San Diego County (*Parry & Lemmon*); also in the State Survey collection, a single specimen, without ticket; a native of Chili. Several of the lower joints of the culm are naked, indicating that it grows in blowing sands. The sheaths are much crowded, the outer ones weather-worn. The whole plant when young of a very pale glaucous green, when old yellowish throughout.

+ + *Spikelets obtuse.*

5. **P. scoparium,** Lam. Culm from a perennial root, 6 inches to 2 feet high, geniculate at the lower nodes and at length branched and reclining: leaves lanceolate, 3 to 5 inches long, about 6 lines wide, indistinctly 9-nerved, mostly erect and somewhat rigid, hairy beneath and fringed with spreading hairs at base; sheaths hairy: panicle 2 to 3 inches long, nearly simple, the hairy slender branches bearing a few large (1½ lines long) tumid obovate usually hairy spikelets: upper glume 9-nerved, twice or three times the length of the roundish lower one: perfect flower (under a strong lens) minutely dotted in longitudinal lines, the lower palet with a transverse furrow or fold near the base. — Encycl. iv. 744 *bis* (there is much confusion in the paging); Chapm. Fl. 675. *P. paucifloruni,* Ell.?; Gray, Manual, 648.

Oregon, *Pickering, Spaulding, Hall, Howell.* Not found as yet within the State, but so frequent in Oregon and elsewhere that its occurrence is very probable. It extends from New England westward, also southward, where the plant is much larger than any Oregon specimens. Late in the season it branches, taking on a variety of forms, some of which are velvety hairy. The fold or crease at the base of the perfect floret appears to have been overlooked; it seems to be quite characteristic of this species.

6. **P. dichotomum,** Linn. Culm from a few inches to 2 feet high, erect and simple or, late in the season, decumbent and variously branched: lower leaves usually ovate, the upper linear-lanceolate, smooth or hairy or velvety: terminal panicle open, ovoid, those of the branches short and often included in the sheaths; spikelets a line long, oblong-obovate, smooth or hairy: lower glume roundish, one-third the length of the 5 – 7-nerved upper one. — *P. thermale,* Bolander, Proc. Calif. Acad. ii. 181.

Yosemite Valley, the Geysers, and on Lassen's Peak, at an altitude of 4,500 feet. Found all over the country, and presenting an endless variety of forms, many of which have been described as species. It assumes a very different appearance after the first flowering, when it begins to flower upon the numerous branches. Some forms smooth and shining, but all thus far collected in the State are hairy. *P. thermale* was described from a densely velvety low and much branched state.

§ 3. *Spikelets crowded in 3 or 4 rows or irregularly on the one-sided spike-like branches of the panicle.* — ECHINOCHLOA.

7. **P. Crus-galli,** Linn. (BARN-YARD GRASS.) Annual, with culms from a few inches to 4 feet high, stout, branching from the base: leaves lanceolate, ½ inch wide or more, rough on the margins and, with the sheaths, usually smooth otherwise: panicle mostly dense and pyramidal, often secund, rarely with distant and somewhat appressed branches; spikelets 1 to 2 lines long, often clustered and densely crowded upon the numerous one-sided branches, which usually bear coarse hairs, especially at base: glumes rough upon the nerves, ovate, abruptly pointed: lower palet of sterile floret awl-pointed or short-awned, but mostly with a rough awn an inch long or more; perfect floret pointless or with a short point. — Trin. l. c., t. 161. *Echinochloa Crus-galli,* Beauv.; Reichenb. l. c., t. 191.

Common in rich grounds. A native of Europe and possibly indigenous to some parts of this continent; widely introduced as a weed of cultivation in all warm countries. Exceedingly variable, and as many of the forms have received names the synonyms are many. In the Bad Lands of Nebraska perfect plants are found only two inches high, while in rich spots five feet is not an unusual height. There are all degrees, from perfectly smooth sheaths and leaves to those with long hairs, and a very rough pubescence is not rare. The panicles and sometimes the sheaths are often tinged with purple, but are sometimes so pale that one form has been called var. *glaucum.* From the large pyramidal compound panicle there is every grade down to a nearly simple one, with scarcely branched spikes erect, appressed and distant upon the rhachis, in which condition it is liable to be mistaken for *P. colonum.* This, which was formerly regarded as a worthless weed, has been, within a few years, cultivated in Illinois and some neighboring States as a hay-crop.

8. **P. colonum,** Linn. Culms 6 inches to 2 feet high, annual, branching or simple, usually decumbent and rooting at base: leaves linear and, with the sheaths, glabrous: panicle of three to twelve or more short (½ to 1 inch) perfectly simple distant usually erect spikes, which are mostly bearded at base; spikelets in two to four rows, a line long or less, awnless: glumes and lower palets nearly smooth or hispid on the nerves, pointed but not awned: fertile flower barely pointed. — Trin. l. c., t. 160. *P. Walteri,* Ell. Sketch, i. 115; Chapm. Fl. 557.

San Diego County; Arizona and Northern Mexico; also in the Southern Atlantic States. Common in the warm countries of the Old World; also in Australia. This much resembles some of the small and smooth forms of *P. Crus-galli,* but in this the spikes or branches of the slender panicle are entirely simple and unbranched, while in the other they are more or less compound, though the subdivisions are sometimes obscure and small. Perfect floret much less pointed than in the preceding.

P. CALIFORNICUM, Benth. Bot. Sulph. 55, was collected in Lower California; it probably does not extend into the State, as no specimens according with the description occur in the various collections.

P. STRUMOSUM, Presl, Rel. Hænk. i. 303, is accredited to the State. Trinius (Paniceæ, 255) suggests that it is very near *P. gibbum,* Ell. It is difficult to identify Presl's species from his descriptions.

3. SETARIA, Beauv. BRISTLY FOX-TAIL GRASS.

Panicle dense, cylindrical, spike-like, sometimes interrupted below. Spikelets as in *Panicum,* awnless, with the short peduncles produced beyond them into one or several awn-like bristles which are at one side, not forming a complete involucre.

A genus of annuals, of about 20 species, natives of tropical countries, and introduced in most temperate climates. By some botanists it is placed as a section of *Panicum,* from which it differs in its spike-like inflorescence and the bristles subtending the spikelets. *S. Italica* in some of its varieties is cultivated as "Millet," and its var. *Germanica,* known as Hungarian Grass, is a useful forage plant, often sown to supplement a short hay-crop.

1. **S. glauca,** Beauv. Culm erect, 1 to 2 feet high: spike 1 to 4 inches long, cylindrical, compact and usually tawny yellow: bristles in clusters of 6 to 11, much exceeding the spikelets, barbed with numerous minute teeth which point upwards: perfect floret with numerous transverse wrinkles, especially when mature. — Reichenb. Icon. Fl. Germ. i. 68, t. 188. *Panicum glaucum,* Linn.; Trin. Sp. Gram. ii. t. 195.

Sacramento and elsewhere; found as a weed nearly all over Europe and the United States. The closely related *S. viridis*, Beauv., is also a common weed and may be expected to occur in California; it differs from the above in its green color, shorter bristles, and the absence of the transverse wrinkles to the perfect floret, which is striate lengthwise and dotted.

S. CAUDATA, Roem. & Schult., abundant from the Rio Grande westward, was collected by the Ives Colorado Expedition, and may be met with in the eastern counties. It is about two feet high, with a long narrow spike, which is often nodding and usually much interrupted below.

S. CALIFORNICA, Kellogg (Proc. Calif. Acad. i. 276), was described from a specimen collected in Shasta, said to have been 10 to 12 feet high. In his account of it, Dr. Kellogg says that it is "quite similar to *S. Italica* and *S. Germanica*." As so striking a grass as to size has not been found by later collectors, it seems probable that he was misinformed as to its being a native, and that it was introduced without becoming established.

4. CENCHRUS, Linn. BUR-GRASS. HEDGEHOG-GRASS.

Spike simple, the flowers inclosed in an involucre at length coriaceous and bristly or spiny, containing one to five two-flowered spikelets, with one floret abortive as in *Panicum*. Glumes two, membranaceous, the lower small (sometimes wanting), the upper 3 – 5-nerved and more or less shorter than the florets. Lower floret staminate or neutral, with one or two palets; the lower acute or acuminate, 5 – 7-nerved. Upper or perfect floret lance-ovate, acute; lower palet somewhat chartaceous, closely embracing the upper. Scales none. Stamens 3. Ovary oblong: styles 2, united below; stigmas somewhat plumose. Grain oblong, smooth, free.

A small genus, mostly tropical, extending on this continent to the temperate regions. Culms mostly branching. The inflorescence surrounded by involucral scales united below, and forming when mature a head which is often hard and spiny.

1. **C. tribuloides**, Linn. Culms from an annual root, 1 to 2 feet long, ascending: leaves linear, flat: spike of 2 or 3 heads, or oblong of 8 to 20 erect or spreading spherical usually whitish heads, which are wedge-shaped at base, 2 to 4 lines long, covered with spreading barbed more or less downy short spines, and containing 2 or 3 spikelets. — *C. spinifex*, Cav. Icon. v. 38, t. 461. *C. pauciflorus*, Benth. Bot. Sulph. 56, a few-flowered form.

Sandy localities, from New England westward, especially on the margins of lakes and rivers. It is a troublesome weed, as the spiny heads, parting readily from the stem, cling to clothing and to the bodies of animals, and it should be exterminated in sheep-raising districts especially, as it fastens itself most tenaciously to the fleece and diminishes its value. It is known in different parts of the country as Hedgehog-, Bur- and Cockspur-Grass. The form called *C. pauciflorus* was originally collected in Lower California and since on Carmen Island by *Dr. Palmer*.

C. MYOSUROIDES, HBK. (Nov. Gen. i. 115, t. 35), grows in Sonora and eastward and may be expected in the southern part of the State. It is a robust erect species, 2 to 6 feet high, with a narrow spike 3 to 5 inches long, of small densely imbricated heads with erect spines and containing but a single spikelet.

5. ISCHÆMUM, Linn.

Inflorescence in a simple articulated spike. Spikelets in pairs at each joint of the rhachis, one sessile, the other pedicelled; sessile spikelet much flattened, imbricated, 2-flowered, the lower floret staminate, the upper perfect: pedicellate spikelet (in our species) reduced to a single abortive flower consisting of but one glume. Glumes unequal, the lower and outer larger, chartaceous or somewhat coriaceous, 5 – 9-nerved; the inner 3 – 5-nerved, sometimes awned. Florets completely inclosed; palets very thin and hyaline, the upper sometimes very small or none, the lower palet of the upper floret sometimes with an awn. Stamens 3. Styles 2, distinct. Grain inclosed in the palets but free.

A genus of a dozen or more species, chiefly Asiatic and Australian, a few being found in tropical America and Africa. The genus is by some included in *Andropogon*.

1. **I. leersioides,** Munro. Culms slender, a foot high or more, roughened and bearded at least at the upper nodes: leaves narrowly linear, the lower 3 or 4 inches long, the upper shorter, and uppermost with little or no blade, scabrous above and strongly ciliate near the base, the point subcartilaginous; ligule very short, truncate; sheaths scariously margined, very loose, mostly much shorter than the internodes, crowded below: spikes 1 to 4, about an inch long, solitary on slender pubescent peduncles (4 to 6 inches long) from the upper sheaths, unilateral, erect or somewhat curved; joints of the rhachis strongly concavo-convex, smooth or very minutely pubescent: sessile spikelets loosely imbricate, about 1½ lines long, the broad outer glume somewhat obtuse, 9-nerved, the stout marginal nerves conspicuously ciliate with long spreading bristles; upper glume shorter, acute, broadly 2-nerved, carinate in the middle; sterile spikelet nearly a half shorter, of a single closely convolute glume: awns none. — Proc. Am. Acad. iv. 363.

Collected in San Francisco, near a Chinese warehouse, *Bolander*. A native of southern China, evidently introduced, but whether it has become naturalized is not known. It is near *I. pectinatum*, Trin., which has much longer spikes and larger spikelets, with the lower glume winged as well as fringed. Our grass is apparently an annual.

6. LEERSIA, Soland. False-Rice.

Panicle loose, its base often enclosed by the upper sheath. Spikelets much flattened, more or less crowded and overlapping one another, awnless, jointed with the pedicels, one-flowered. Glumes none. Palets hard, strongly flattened laterally, fringed on the keel with bristly hairs; the upper 1-nerved, the lower as long but much broader, 3-nerved, enclosing the flattened grain. Stamens 1, 3, or 6. Ovary smooth: styles short; stigmas feathery with branching hairs.

A small genus of perennial marsh grasses, mostly American, with a few species in the temperate and warmer portions of the Old World and in Australia; five species are found in the Eastern States, of which but one occurs on the Pacific. The leaves and sheaths are very rough. The spikelets upon the loose portion of the panicle are usually sterile, the ovary in these being abortive, while those enclosed by the sheaths are fertile. Closely related to the cultivated Rice (*Oryza*) and to the Wild-Rice (*Zizania*), but of no agricultural value.

1. **L. oryzoides,** Swartz. (Rice Cut-Grass.) Culms 2 or 3 feet high, hairy at the joints: leaves long, flat, spreading, ½ inch or more wide and, with the sheaths, very rough upward: paniele much branched, spreading, 6 to 8 inches long; spikelets 2½ to 3 lines long, pale green: stamens 3. — Reichenb. Icon. Fl. Germ. t. 181.

Lake County (*Bolander*), who regards it as introduced, though it is indigenous to Oregon. Very common in the Atlantic States in wet places, where it is known by several common names besides the above, as Cut-grass, White-grass, and in the Southern States as "Rice's Cousin."

7. PHLEUM, Linn. Cat's-Tail Grass. Timothy.

Panicle dense and spike-like, ovoid or cylindrical. Spikelets much compressed laterally, flat, 1-flowered (rarely in some exotic species with the rudiment of a second flower). Glumes boat-shaped, equal, keeled, mucronate or short-awned. Floret shorter than the glumes. Lower palet very thin, truncate, sometimes with a minute awn at base, usually awnless; the upper equalling the lower. Scales 2, hyaline, toothed above. Stamens 3. Ovary smooth: styles long, distinct; stigmas slender, hairy. Grain compressed, enclosed in the palets.

A genus of about ten perennial and annual species in the temperate and arctic portions of both hemispheres, and best known through its cultivated representative *P. pratense*. The other species have the same harsh feeling when the spike is handled that is characteristic of this.

1. **P. pratense,** Linn. Culms from a perennial root, 1 to 3 feet high or more, becoming bulbous at base: leaves short, flat, rough on the edges; sheaths

close; ligule long: spike 1 to 6 inches long: glumes about a line long, with scarious margins and green keel, which is ciliate with stiff hairs and prolonged into a rigid rough awn shorter than itself.

A native of Europe, naturalized in various localities; also extensively cultivated under the name of Timothy (but in New England and New York commonly known as Herds-grass), and furnishing by far the greater portion of the cultivated hay of the country.

2. **P. alpinum,** Linn. Perennial, with culms 1 to 2 feet high: sheaths of the upper leaves very loose or inflated, the lower ones close; ligule short: spike ovoid or oblong, rarely more than an inch long, usually purplish: glumes strongly fringed on the back, bearing an awn about their own length. — Trin. Spec. Gram. i, t. 21; Reichenb. Icon. Fl. Germ. i. 63, t. 179. *P. Hœnkeanum,* Presl, Rel. Hænk. i. 245.

Occurring sparingly near San Francisco, but common in the Sierra Nevada and northward. Found also in the alpine regions of Europe, Asia and North America.

8. ALOPECURUS, Linn. Fox-Tail Grass.

Panicle dense, cylindrical, spike-like. Spikelets much compressed, 1-flowered. Glumes boat-shaped, nearly equal, somewhat united below, keeled but not awned. Floret equalling or barely shorter than the glumes. Lower palet hyaline, 1-nerved, with a very slender awn on the back at or below the middle; upper palet entirely wanting. Scales none. Stamens 3. Ovary smooth: styles long, mostly united; stigmas long with simple hairs. Grain laterally compressed, inclosed in the palet.

There are about 14 mostly perennial species, widely spread over the temperate and colder portions of the globe, one of which, *A. pratensis,* the Meadow Fox-tail, is much valued in Europe as a pasture grass. With much of the aspect of *Phleum,* but soft to the touch, and readily distinguished from that genus by the absence of the upper palet.

* *Culm erect.*

1. **A. pratensis,** Linn. Culms from a perennial root, stoloniferous, upright, 1 to 3 feet high: leaves roughish, flat; sheaths smooth, the upper inflated and longer than its leaf: spike 2 to 3 inches long, obtuse, dense, pale green, soft to the touch: glumes 2 lines long, with short hairs on the keel: palet equalling the glumes, its edges united below; awn variable, usually projecting more than half its length beyond the glumes. — Trin. Spec. Gram. i, t. 44; Reichenb. Icon. Fl. Germ. t. 178.

Probably introduced by the Spaniards, as it was collected in 1846 in Sacramento Valley (*Hartweg*); Walnut Creek (*Brewer*); Ukiah City, *Bolander.* A widely distributed species, native of the Old World, now naturalized in most temperate countries. It is much esteemed as a pasture grass on account of its early and rapid growth.

* * *Culms decumbent.*

2. **A. aristulatus,** Michx. Culms ascending from a decumbent base, 1 to 2 feet high: leaves glaucous: spike about 2 inches long, slender and very pale green: glumes obtuse, the palet slightly exceeding them; awn attached just below the middle of the palet and barely exceeding it: anthers oblong. — *A. geniculatus,* var. *aristulatus,* Torr. in Pacif. R. Rep. vi. 92.

Wet places, Klamath Marshes (*Bigelow, Lemmon*); Virginia City (*Bloomer*); Oregon and northward. This grass, which is common in the Eastern States and in Continental Europe, has little agricultural value.

3. **A. geniculatus,** Linn. Culm procumbent at base, ascending from the lower nodes where it is bent, 6 inches to 1 foot high or more: leaves narrow, glabrous; sheaths loose, but not inflated, the upper leaf equalling its sheath: spike 1 to 2 inches long, closely imbricated and slender; spikelets about a line long: glumes connate at base, silky-hairy, obtuse: palet slightly shorter than the glumes; awn from near its base, and projecting half its length beyond it: anthers linear, purplish. — Trin. l. c., t. 42; Reichenb. l. c.

Moist meadows and marshy places (*Bolander*); Cascade Mountains (*Lyall*); Oregon, *Howell*. Though introduced at the East, it is apparently indigenous on this coast. It is found in Europe, Asia, northern Africa and Australia, where as well as in New Zealand it is "truly indigenous." As it yields but a scanty herbage, which is not much relished by stock, it has little value to the farmer.

9. BECKMANNIA, Host. Beckmann's-Grass.

Panicle long and narrow, with the spikelets crowded upon its branches in two rows. Spikelets two-flowered, or by abortion one-flowered. Glumes boat-shaped, inflated, abruptly pointed, with scarious margins. Florets sessile. Lower palet membranaceous, 5-nerved, in the lower floret terminating in a very acute often curved point. Stamens 3. Styles 2, short, densely covered with simple hairs.

A genus of a single perennial species. In all the American specimens we have thus far examined the upper floret is wanting. It has a wide range from southern Europe to Japan, North America, etc.

1. **B. erucæformis,** Host. Culms 2 or 3 feet high: leaves 4 to 8 inches long and about 3 lines wide, roughish, with an elongated ligule: panicle often a foot long, its usually erect branches solitary, or in twos and threes, and sometimes subdivided: spikelets about 2 lines long, nearly orbicular, green on the keel and somewhat wrinkled transversely. — Gram. iii, t. 206; Reichenb. Icon. Fl. Germ. i. 57, t. 171.

Common northward, extending to Oregon and British America. Mr. Bolander states that this grass forms the greater part of the herbage in the wet meadows of the northern part of the State. According to H. Engelmann the seeds are collected for food by the Utah Indians. Some specimens have much the appearance of a *Paspalum*. The specific name means *caterpillar-shaped*, referring to the resemblance of the branches of the panicle to some green larva.

10. PHALARIS, Linn. Canary-Grass.

Panicle clustered or crowded to form a cylindrical or ovoid spike. Spikelets broad and flattened, with one perfect floret, on each side of which is a neutral one reduced to a mere rudiment or scale. Glumes equal, boat-shaped, usually with a winged keel. Perfect flower shorter than the glumes, flattened, awnless. Lower palet shining, becoming cartilaginous when ripe, enclosing the smaller upper one. Scales 2 and minute, or wanting. Stamens 3. Ovary smooth: styles elongated, united below; stigmas slender, hairy. Grain flat, closely inclosed by, but free from, the palets.

A small genus, chiefly belonging to the Mediterranean region and Central Asia. The most important species is the one which furnishes the Canary-seed of commerce.

§ 1. *Panicle dense and spike-like: the glumes keeled.* — Phalaris proper.

* *Glumes with a broad keel: annuals.*

1. **P. Canariensis,** Linn. Culms 1 to 3 feet high: leaves flat with the upper sheaths much inflated: spike 1 to 1½ inches long, ovoid or somewhat cylindrical, very dense: glumes broad with a conspicuous keel, white on the margin, with a distinct green line within it: rudimentary florets as small lanceolate smooth scales; perfect floret with minute silky hairs.

An introduced annual frequently found near settlements where the rubbish from bird-cages has been thrown. Largely cultivated in Europe and occasionally in this country for the seed, which is a favorite food of cage-birds.

2. **P. intermedia,** Bosc. Culm variable, sometimes 4 or 5 feet high, smooth: leaves short, the upper an inch long or less, often glaucous; sheaths, especially the uppermost, inflated: spike 1 to 2 inches long, ovoid; spikelets 3 lines long: glumes pointed: rudimentary florets linear, hairy, less than half the length of the perfect

one, which is long-pointed, hairy, and one third shorter than the glumes. — Poiret, Encycl. Suppl. i. 300. *P. microstachya*, DC.; Trin. Spec. Gram. i, t. 77. *P. Californica*, Hook. & Arn. Bot. Beechey, 161.

Var. **angusta**, Chapm. Spikes cylindrical, 3 to 6 inches long, narrow and often interrupted toward the base.—*P. angusta*, Nees, Fl. Bras. i. 28, t. 9; Trin. l. c., t. 78.

A widely diffused annual species, common on the southern Atlantic coast, and on the Pacific from northern Mexico to Oregon, where it varies from six inches to six feet in height; in the large forms the stems are as thick as the little finger and the spike, 6 or 8 inches long, is often interrupted at the base. It is known to farmers as "California Timothy," but is of no agricultural value.

* * *Glumes with a narrow keel, often purplish.*

3. **P. amethystina**, Trin. Culms from a perennial root, forming clumps 2 to 8 feet high: leaves and sheaths, often purplish, much as in the preceding: spike oblong, 1 to 2 inches long, usually purple; spikelets 2 lines long or more: glumes but slightly keeled: rudimentary florets hairy, more than half the length of the hairy perfect floret. — Phalarid. 10.

Gulches and ravines; Oakland (*Bolander*); Monterey (*Brewer*), and southward; also in Chili. Sometimes the plant is green throughout, when it closely resembles forms of *P. intermedia*, from which the very narrowly keeled glumes and longer abortive florets distinguish it.

§ 2. *Panicle branched: glumes not keeled.* — DIGRAPHIS.

4. **P. arundinacea**, Linn. (REED CANARY-GRASS.) Perennial; culms 2 to 4 feet high, with long flat leaves about half an inch wide and with the sheaths smooth: panicle 4 to 8 inches long, its roughish branches spreading only at flowering time; spikelets 2 lines long, ovate: glumes pointed, 3-nerved: rudimentary florets reduced to narrow silky scales, one third as long as the perfect one, which is smooth or silky, and one third shorter than the glumes.

Not common in the State, but collected near Sacramento by the Wilkes Expedition; found in Oregon and northward, and common in the northern Atlantic States and in the temperate and arctic portions of the northern hemisphere. Wet grounds and river banks, where it is sometimes abundant enough to cut for hay, but not much valued. The "Ribbon-grass" or "Striped-grass" of the gardens is a form of this with variegated leaves.

11. HIEROCHLOE, Gmelin. HOLY GRASS.

Panicle loose and spreading. Spikelets laterally compressed, 3-flowered, the two lower and lateral ones staminate, the upper or central one perfect. Glumes about equal, scarious, 3-nerved, as long as or exceeding the florets. Staminate flowers sessile, with three stamens. Palets scarious, the lower 5-nerved, sometimes with a short awn; the upper 2-nerved. Perfect flower short-pedicelled; the lower palet chartaceous, 5-nerved, awnless; the upper 1-nerved. Scales 2, lanceolate. Stamens 2. Ovary smooth: styles long; stigmas hairy. Grain terete, free.

A genus of about a dozen species of perennial grasses, with flat and sometimes broadly linear leaves, natives of cold and arctic regions. When dried the plants give off a pleasant vanilla-like odor, on which account they were formerly strewn before church doors on Christmas and other holy days, whence the name "Holy-grass," the generic name having the same meaning.

1. **H. macrophylla**, Thurb. (LARGE-LEAVED VANILLA-GRASS.) Culms 2 to 3 feet high, forming large tufts, with leaves 12 to 18 inches long and 4 to 8 lines broad, rough upon the upper surface and margins: panicle with rather distant branches in pairs: glumes greenish along the very distinct nerves, obtuse and barely equalling the staminate florets, the lower palets of which are strongly fringed on the margin, notched at the broad apex, and often with a slight mucro or awn; perfect floret pubescent towards the apex, otherwise smooth and shining, the lower palet very obtuse and fringed on the margin. — Boland. in Trans. Calif. Agric. Soc. 1864–65, 132. *H. borealis*, Torr. in Pacif. R. Rep. iv. 154.

Redwoods of the Coast Range, *Bolander*, n. 2279. A very robust species, differing in its inflorescence from any large-leaved form of *H. borealis* that we have seen, and distinguishable from it at once by the greenish color of the panicles, which in that are always brownish. That species, the "Seneca-grass" of the Eastern States, has been found in Washington Territory and Oregon, and is likely to occur within the borders of the State. It may be recognized by the brown color of the spikelets, even when young, its pointed glumes and palets, and its much smaller leaves.

12. ANTHOXANTHUM, Linn. Sweet Vernal Grass.

Panicle cylindrical, spike-like. Spikelets 3-flowered, the lateral florets neutral and consisting of a single palet; the upper or central one perfect. Glumes thin, unequal, the lower smaller, 1-nerved, the upper about twice the length of the lower and 3-nerved. Palet of neutral florets awned. Perfect floret small, of two chartaceous smooth obtuse palets, the upper one 1-nerved. Scales none. Stamens 2, large, linear, yellow. Ovary glabrous: styles long; stigmas feathery. Grain ovate, enclosed in the palets.

A perennial genus of three species, which some botanists regard as one, found in temperate regions all over the world. Like *Hierochloe* it gives off a pleasant odor in drying.

1. **A. odoratum,** Linn. Culm erect and rather slender, 1 to 2 feet high: leaves flat, hairy; sheaths often hairy, the ligule short, obtuse: panicle 1 to 5 inches long, interrupted below, often brownish; spikelets 3 to 4 lines long: neutral palets 2-lobed, hairy, one with a bent awn from near the base, the other short-awned below the tip; the longest awn sometimes protruding beyond the glumes. — Trin. Spec. Gram. i, t. 14; Reichenb. Icon. Fl. Germ. i. 66, t. 183.

Meadows, *Bolander*. A well-known grass, introduced from Europe. It is not regarded as very nutritious, but its presence in meadows is welcomed, as it imparts its odor to other grasses, and is supposed to give a flavor to butter. It flowers in spring, and often again in autumn.

13. ÆGOPOGON, Willd. Goat's-beard Grass.

Panicle racemose and mostly secund. Spikelets in pairs or threes, one perfect, very shortly pedicelled, often larger than the one or two other longer pedicelled ones, which are staminate or neuter. Glumes equalling or shorter than the floret, with one nerve prolonged beyond the apex as an awn between two lateral shorter awns or teeth. Lower palet of perfect floret 3-nerved, awned at the acute tip or with three awns, the lateral much shorter; upper palet acute or bearing two short awns. The sterile spikelets similar in structure, but often smaller. Scales 2, minute. Stamens 3. Ovary linear-oblong, smooth: stigmas plumose. Grain free.

A genus of about six small annuals and perennials, natives of South America and Mexico; they have much the aspect of *Chloridæ*.

1. **Æ. cenchroides,** Willd. Culms 6 to 12 inches high, slender, decumbent and bent more or less at the nodes: leaves linear, flat, 1 to 2 inches long and less than a line broad, and with the sheaths barely scabrous; ligule 1½ lines long, bifid; lower sheaths shorter than the internodes: panicle 2 or 3 inches long, slender, loose: spikelets in threes, nearly equal, upon a short scabrous strongly curved or bent ray or branch, all very shortly pedicelled: glumes nearly equal, about half the length of the floret, mostly reddish, scabrous, wedge-shaped, 1-nerved, bifid at apex with a straight awn about its own length between the shorter teeth: palets nearly equal, the lower slightly longer and 3-nerved, the central awn about twice the length of the two lateral ones; the upper palet with two short setæ between two lobes; the central awn to the lower palet of the perfect floret usually longer than the others in the cluster. — HBK. Nov. Gen. & Spec. i. 132, t. 42; Trin. Agrost. i. 7.

Sent by *Mr. Bolander* without locality, and probably introduced from lower down the coast. According to Kunth all three spikelets sometimes have perfect flowers.

14. COLEANTHUS, Seidel. Sheath-flowering Grass.

Panicle, like the whole plant, minute, simple or branched, the flowers in umbellate clusters of short 1-flowered rays. Spikelets between one half and one line long. Glumes none. Palets membranaceous, very unequal, the lower longer, 1-nerved, acuminately awned; the upper one-half shorter, with two divergent nerves, 2-keeled, bifid at apex, the divisions acuminate. Scales none. Stamens 2; anthers oblong. Ovary sessile, smooth: stigmas sessile, denticulate with subulate hairs. Grain oblong, somewhat longer than the palets, which are persistent and surround its base, the surface roughened with minute dots.

The genus comprises but a single annual species, with flowers of exceedingly simple structure. Trinius regarded the series of floral envelopes as glumes, and described a palet which others fail to make out.

1. **C. subtilis**, Seidel. Culms slender, forming loose tufts, 1 to 3 inches high, decumbent at base, ascending, geniculate, often branched below: leaves about ½ inch long and wide in proportion, curved, smooth; ligule elongated, acute; sheaths all loose and dilated, scarious on the margins, the upper inflated: panicle ½ to 1½ inches long, its base included in the upper sheath, mostly simple with three or four umbellate clusters, sometimes with one or rarely two short branches, with an umbel at the end; pedicels longer than the spikelets, scabrous: palets roughened on the keel. — Reichenb. Icon. Fl. Germ. i. 61, t. 177. *Schmidtia utriculosa*, Sternb.; Nees, Gen. t. 27.

Sauvies Island, Oregon, *Howell*. This, which until Mr. Howell's discovery was only known as a rare grass in northern Europe, is so very small that it may readily escape notice. It is to be looked for along the muddy margins of rivers, especially in the northern part of the State.

15. VILFA, Adans. Rush-Grass.

Panicle narrow, dense and spike-like or sparsely flowered, sometimes included by the upper sheath. Spikelets 1-flowered, membranaceo-chartaceous. Glumes 1-nerved, not awned but sometimes pointed, the lower usually smaller. Floret sessile or with a very minute callus, usually longer than the glumes. Palets similar in texture to the glumes, mostly equal, the lower 1- or indistinctly 3-nerved, often obtuse, awnless, but sometimes terminated by a very short point or seta. Scales 2, small. Stamens 3. Ovary oblong: stigmas with simple hairs. Grain oblong or cylindrical.

Perennials and annuals, with mostly wiry culms and involute leaves, the sheaths of which are sometimes fringed at the throat. The species are widely distributed; three or four occur in the Atlantic States. See note to *Sporobolus*.

1. **V. depauperata**, Torr. Culms tufted, very slender, 3 inches to 2 feet long, decumbent and geniculate, often much branched: leaves from 3 to 12 lines long, often involute, very minutely scabrous on the upper surface; ligule elongated, acute; sheaths rather loose, crowded and overlapping below: panicle ½ to 2 inches long, very narrow, of few solitary distant erect rays, which are branched and flower-bearing nearly to the base: spikelets a line long or less, short-pedicelled: glumes ovate, obtuse, nearly equal: floret about twice the length of the glumes, often blackish, deciduous: palets nearly equal, the lower obscurely 3-nerved, the midnerve often terminating as a minute mucro. — Hook. Flor. Bor.-Am. ii. 257, t. 236; Watson, Bot. King Exp. 376. *V. utilis*, Torr. in Pacif. R. Rep. v. 365.

High Sierras (*Brewer*); Yosemite Valley (*Bolander*); Tejon Pass (*Blake*); Hermit Valley, *Hooker* and *Gray*, and other mountain localities by *Lemmon* and others. Ranging from Oregon (*Hall*) to Colorado and the Saskatchewan, and southward to Northern Mexico and Western

Texas. A perennial species, varying so greatly with the locality that it is not practicable to indicate any well-defined varieties. Specimens from the high Sierras are very dwarf, with capillary culms; those collected at Tejon Pass by Mr. Blake are like those from Northern Mexico, a tangled mass of long flexuose filiform and very tough culms. This appears to be the form assumed by the plant in the southern localities, where it is much sought after by the Mexicans, who use it for stuffing their large leathern *aparejos*, or pack-saddles, a purpose to which its toughness and elasticity especially adapt it. It was this use of it which led Dr. Torrey to give the name *V. utilis*.

2. **V. gracillima.** Culms annual, capillary, smooth, much branched at base, forming small dense tufts, 3 to 12 but usually about 6 inches high, the leafy portion about 2 inches high: leaves 6 to 9 lines long and less than a line broad, flat, involute at apex, very minutely scabrous on the upper side and margins; ligule about a line long, obtuse and lacerate, decurrent; sheaths equalling the internodes, loose, striate, smooth with hyaline margins: panicle long-exserted, narrowly linear, few-flowered, interrupted below; rays in pairs or threes, erect, appressed, 1 – 3-flowered: spikelets about a line long, on shorter pedicels: glumes subequal, or the upper larger, membranaceous, colorless, very obtuse, distinctly 1-nerved, mucronate or erose-toothed at apex, about half as long as the oblong-lanceolate floret, which has a small callus: palets about equal, blackish, the lower 3-nerved, with a few very minute hairs on the nerves below, mucronate or tipped with a small seta.

In the Sierra Nevada, in wet soil, at 11,000 feet altitude (*Brewer*); Yosemite Valley (*Bolander*); also collected by *Mrs. Austin* and *Lemmon*, and near Santa Barbara by *Mrs. Cooper;* Oregon, *Hall.* This occurs in dense moss-like tufts 2 or 3 inches across, the bright green foliage being about two inches high; above this the numerous depauperate panicles are borne by wiry shining naked culms, scarcely larger than a horse-hair. At first taken for a variety of *V. depauperata*, Torr., but its habit and annual root abundantly distinguish it from any of the many forms of that species; with *V. cuspidata*, Torr., and one or two other species, it approaches closely to *Muhlenbergia.*

16. SPOROBOLUS, R. Br. Drop-seed Grass.

Panicle usually open and pyramidal, sometimes contracted with erect rays. Spikelets 1-flowered. Glumes chartaceo-membranaceous, 1-nerved or nerveless, mostly obtuse, awnless, the lower one smaller. Floret without callus and longer than the glumes. Palets similar in texture to the glumes. Scales 2. Stamens 2 or 3. Grain globular, the seed loose within the usually hyaline pericarp, which ultimately bursts and allows it to fall away.

Annuals and perennials, widely distributed; there are 7 species in the Atlantic States. There is much confusion in different works as to *Sporobolus* and *Vilfa*, some authors adopting the one or the other name, according to their views of priority, and not admitting that there are two genera. Dr. Gray long ago (Manual) adopted the free or adherent seed as a sufficient generic distinction, placing those species having a spiked panicle and the fruit a true *caryopsis*, the seed adherent to the pericarp, in *Vilfa*, while those with the generally open panicle and the fruit a *utricle*, i. e. the seed free from the (usually) hyaline pericarp, are included in *Sporobolus.* This arrangement is followed here. The pericarp usually bursts spontaneously when quite ripe; in immature specimens a brief soaking of the fruit in water will cause the separation to take place.

* *Spikelets a line long: glumes very unequal.*

1. **S. cryptandrus**, Gray. Culms 2 or 3 feet high, usually geniculate and branched below: leaves flat, about 2 lines wide, acuminate, scabrous especially above; ligule a mere fringe; sheaths smooth, strongly bearded at throat, the lower shorter than the internodes: panicle narrowly pyramidal, more or less inclosed by the upper sheath, 4 to 8 inches long, its rays mostly in pairs, spreading, flower-bearing to the base and sometimes hairy in the axils: spikelets 1 line long, short-pedicelled, rather crowded, lead-colored: glumes somewhat acute, the upper twice the length of the very narrow lower one: floret equalling the upper glume. — Manual, 2 ed. 542 (5 ed. 610). *Agrostis cryptandra*, Torr. in Ann. Lyc. N. York, i. 151. *Vilfa cryptandra*, Trin. Agrost. i. 47; Steud. Syn. Gram. 156; Watson, Bot. King Exp. 375.

Var. **flexuosus,** Thurb. Panicle elongated, somewhat narrow but open, the rhachis very slender and flexuose, the shorter rather distant rays spreading and sometimes reflexed; spikelets usually much darker colored than in the normal form. — Vasey, Bot. Wheeler's Expl. 282.

Sierra Nevada (*Torrey*); Colorado River (*Newberry*); the variety. The typical form, which has not yet been collected within the State, occurs in Oregon (*Hall*) and in the valleys of Northern Nevada, in Colorado and the Rocky Mountains, eastward to New England, and southward to New Mexico and Texas. An annual, with a rather narrow panicle, which is sometimes very slowly liberated from the upper sheath; in the variety it is very slender and wavy, but there is no other difference.

2. **S. airoides,** Torr. Culms forming large tufts, clothed below by the dead sheaths, rarely branched at base, 2 to 3 feet high, somewhat rigid, smooth: leaves very pale, convolute and tapering to a filiform apex, those of the radical tuft about half equalling the culm, those of the culm 4 or 5, the uppermost reduced to a mere filiform appendage to the sheath less than an inch long; ligule nearly obsolete; sheaths smooth with a few long hairs at the throat, the lower two overlapping, the others shorter than the internodes, the uppermost dilated and loose: panicle broadly pyramidal, soon exserted, 6 to 12 inches long, few-flowered; rays solitary or in pairs, slender, spreading or reflexed, with rather distant branches, which are naked below: spikelets a line long, brownish, on rather longer pedicels: glumes rather obtuse, the lower narrower and $\frac{1}{3}$ to $\frac{1}{2}$ the length of the upper: floret slightly longer than the upper glume; palets about equal. — Marcy's Rep. 300. *Agrostis airoides,* Torr. in Ann. Lyc. N. York, i. 151. *Vilfa airoides,* Steud. Syn. Gram. 162; Watson, l. c. *S. (Vilfa) diffusissimus,* Buckl. Proc. Acad. Philad. 1862, 90.

San Joaquin Valley (*Bolander*); Fort Mohave, *Cooper, Lemmon.* Extends eastward to Nebraska and southward to New Mexico and Texas, growing chiefly in alkaline soils. A rather showy perennial, on account of its remarkably pale foliage and broad brownish or brown-purple panicles. Mr. C. J. Croft, U. S. Army, states (Proc. Calif. Acad. iii. 206) that it is very abundant in the Gila Valley, and that animals eat it readily when green. It is, however, said to be a powerful diuretic.

* * *Spikelets less than a line long: glumes nearly equal.*

3. **S. ramulosus,** Kunth. Annual, the culms tufted, 3 to 8 inches high, very slender and branched below: leaves from $\frac{1}{2}$ to 2 inches long, flat or involute, scabrous on the margins; ligule short, obtuse, often split; sheaths very loose, mostly longer than the internodes: panicle very long for the size of the plant, constituting three-fourths of its height, the capillary few-flowered mostly solitary rays rather distant and spreading, the secondary branches 1 – 2- (rarely 3-) flowered: spikelets less than $\frac{1}{2}$ line long, on much longer pedicels: glumes nearly equal and mostly ciliate-fringed on the margin, at least at the apex: floret $\frac{1}{2}$ or $\frac{1}{3}$ longer than the glumes; palets nearly equal, the lower somewhat acute and scabrous on the back. — Kunth, Enum. i. 215, and Suppl. 172. *Vilfa ramulosa,* HBK. Nov. Gen. i. 137, t. 684. *Agrostis minutissima,* Steud. Syn. Gram. 171.

Mono Lake (*Bolander*); banks of the Truckee River (*Watson*); Colorado, New Mexico, Texas and Mexico. The spikelets are often brownish or lead-colored, and the glumes sometimes lack the fringe of hairs, which is usually conspicuous. The leaves and sheaths soon wither and in some specimens there is little besides the panicle.

4. **S. asperifolius.** Culms 6 to 15 inches long, branched, decumbent at base and by taking root at the joints forming broad matted tufts: leaves flat, 1 to 3 inches long, about a line broad, scabrous, especially on the margins and upper surface; ligule very short, truncate; sheaths smooth, loose, much crowded and overlapping below and longer than the internodes: panicle included at base, open, 3 to 5 inches long, pyramidal or ovoid in outline, the scabrous rays solitary or in pairs, bearing nearly to the base 3 – 4-flowered capillary branches: spikelets less than a line long, on pedicels 6 lines long: glumes nearly equal, acute, minutely scabrous: floret slightly exceeding the glumes, the lower palet with sometimes a minute mucro

at its obtuse tip. — *Vilfa asperifolia*, Nees & Meyen in Trin. Agrost. i. 73; Stend. Syn. Gram. 160; Watson, l. c. 375. *Sporobolus* (*Vilfa*) *arenaceus*, Buckl. in Proc. Acad. Philad. 1862, 89.

Mono Lake (*Bolander*), and frequent in alkaline soils through northern Nevada to Oregon (*Nuttall*), eastward to Nebraska, and southward to Texas and Mexico; also Chilian. While the Californian specimens appear as if the species was an annual, those from the Rocky Mountains have the root of a perennial; the leaves are pale green, sometimes erect, much crowded and rather rigid, but none are sufficiently rough to make the specific name descriptive. Specimens were collected in Colorado by *Wolf* in which the ovary was ergotized and the spikelets 2- and 3-flowered, an abnormal state which might be ascribed to a diseased condition did not specimens apparently perfectly healthy, collected by Dr. Torrey in Nevada, have almost uniformly two florets in the spikelet, giving the plant much the appearance of an *Eragrostis*.

17. POLYPOGON, Desf. Beard-Grass.

Panicle dense and spike-like or somewhat branched or lobed. Spikelets 1-flowered, very small, rarely exceeding a line in length. Glumes nearly equal, compressed, 1-nerved and bearing a long awn at or below the apex. Floret much shorter than the glumes, without manifest callus, and naked at base. Lower palet hyaline, broad, 1-nerved (or obscurely 5-nerved), truncate, toothed, awned at the apex. Scales 2, falcate, entire, as long as the ovary. Stamens 3; anthers small. Styles short, with long feathery stigmas.

A genus of about a dozen mostly annual and widely distributed species, especially in warm countries, usually growing upon the seashore and in sandy waste places. It is closely allied to *Agrostis*, from which it is distinguished by its conspicuously awned glumes. Of no known economical value.

1. **P. Monspeliensis**, Desf. (Annual Beard-Grass.) Culms 6 inches to 2½ feet high, procumbent and geniculate at base, rarely erect, often branching from the lower nodes: leaves broad, flat, somewhat scabrous; sheaths smooth; ligule 2 or 3 lines long, obtuse: panicle 2 to 6 inches long, cylindrical or somewhat interrupted, yellowish, dense and soft: spikelets about a line long: glumes notched at the apex and emitting an awn two or three times their length: lower palet with an awn equalling or slightly exceeding the glumes. — Reichenb. Icon. Fl. Germ. i. 15, t. 91; Doell, Fl. Bras. fasc. lxxix. 44, t. 12.

From Oregon to San Diego County, chiefly in the mountains, not rare; also in Northern Nevada and Southern Utah, and on the Atlantic coast. It occurs nearly throughout Europe, also in Asia and Africa. On account of the light color of its dense panicle it is a rather conspicuous grass.

2. **P. littoralis**, Smith. Culms from a perennial root, forming large tufts, 1 to 2 feet long or more: leaves rather narrow, scabrous on both sides; ligule 1 to 3 lines long, acute: panicle narrow, much lobed its whole length and sometimes completely interrupted below, usually purplish: glumes more or less pubescent and distinctly aculeate on the keel, tapering into an awn of about their own length: awn of lower palet slightly exserted beyond the glumes. — Reichenb. l. c., t. 92 (n. 172). *P. fugax*, Boland. Cat. 34.

Wet places, San Francisco and Oakland (*Bolander*, *Lemmon*); Oregon, *Howell*. Coasts of western Europe and the Mediterranean; South America. This was at first referred to *P. fugax*, Nees (which Trinius places as a variety of the preceding), and is so given in Bolander's Catalogue. It is readily distinguished from the other by its narrower, often interrupted panicle, which on account of its shorter awns feels much harsher, also by its frequent purplish tinge or, when that is not present, by the darker green color of the panicle. Mr. Bolander regarded it as an annual, but the specimens are all without roots.

18. AGROSTIS, Linn. Bent-Grass.

Panicle open and spreading, sometimes contracted and narrow, the rays whorled, often in clusters of several. Spikelets small (½ to 2 lines long), 1-flowered or (rarely)

with the rudiment of a second. Glumes somewhat unequal, the lower rather longer, obtuse or acute, but pointless or awnless (except in n. 11), membranaceous. Floret mostly shorter than the glumes, with a very short naked or hairy callus. Palets one or two, very thin, the lower 3–5-nerved, pointless, naked, often bearing a slender straight awn on the back usually much below the apex; upper palet obsolete, or present and shorter than or equalling the ovary, rarely nearly as long as the lower palet. Scales 2, entire. Stamens mostly 3. Styles 2; stigmas feathery. Grain free, terete, smooth.

A rather large genus, widely distributed in cold and temperate climates; the number of species is estimated at about 60, though over 200 are recorded. In high latitudes the species vary greatly, especially as to the awn, the presence or absence of which has little value as a character. They are mostly perennials, with slender low culms which form dense tufts. A few are useful as pasture grasses, but on account of the general sparseness of their foliage are not much valued for mowing.

* *Spikelets with the rudiment of a second floret.* — PODAGROSTIS, Griseb.

1. **A. æquivalvis,** Trin. Culm 1 to 2 feet high, erect, slender, smooth: leaves flat, 4 to 6 inches long, the uppermost very short, and about a line wide, smooth or nearly so, very pale green; upper ligules about a line long; sheaths smooth, shorter than the internodes: panicle 2 to 6 inches long, loose, very narrow, smooth and shining, the distant rays in whorls of 5 below, in pairs or solitary above, very unequal, the longer 1½ to 2 inches long, nearly smooth and mostly flower-bearing above the middle: spikelets from 1 to 1½ lines long, mostly in pairs, one with a pedicel shorter and the other with one longer than itself, sometimes purplish: glumes nearly equal, acute, the upper 3-nerved: floret equalling the glumes, with a minutely hairy callus, and a small hairy rudiment ¼ or ⅓ its length: lower palet acute, 5-nerved; upper palet about as long as the lower. — Agrost. ii. 116. *A. canina,* var. *æquivalvis,* Trin. in Bong. Veg. Sitch. 171. *A. Hillebrandii,* Thurber; Boland. in Trans. Calif. Agric. Soc. 1864, 136.

Calaveras County (*Dr. Hillebrand*); Mariposa Grove (*Bolander*); Oregon, *Hall.* Also Sitka and Unalaschka. A perennial according to Trinius, but all our specimens lack the root and the weak culm has much the appearance of an annual. Trinius describes the rudiment in the far northern specimens as two-thirds the length of the floret, but it does not reach that in those collected in California and Oregon. In the Oregon plant the panicle is shorter and the flowers purplish, while the Calaveras County specimens are noticeable for the unusually pale green of both panicle and foliage.

* * *Spikelets strictly* 1*-flowered, without the rudiment of a second floret.*

+ *Upper palet present, one third (or more) the length of the lower.* — AGROSTIS proper.

++ *Panicle elongated.*

2. **A. alba,** Linn. Culms varying from a few inches to 2 feet high, sometimes decumbent at base: leaves flat, short, smooth or roughened; sheaths smooth; ligule short and truncate or long and acute: panicle slender, usually spreading when in flower and more or less contracted afterwards, green, purplish or brownish, rays roughish: spikelets one line long or less: glumes nearly equal, the lower slightly longer: floret slightly shorter than the glumes, the brief callus with some very minute hairs; lower palet very thin, 5- or 3-nerved, rarely with a short awn; upper palet ⅓ to ½ the length of lower. — *A. stolonifera,* Linn.; Reichenb. Icon. Fl. Germ. i. 9, t. 133–137, 139. *A. vulgaris,* With.; Reichenb. l. c., t. 130–132.

A native of Europe, introduced in most of the cultivated portions of the State and of the country, and exceedingly variable, its different forms having given ground for over 30 nominal species. In most works *A. alba* and *A. vulgaris* are kept distinct, perhaps from the fact that they are recognized as different in agriculture, the only botanical character that can separate them being the difference in the length of the ligule. They may be distinguished as follows: — var. *alba*

proper, with elongated acute ligule, and the panicle contracted after flowering; known as Fiorin Grass, White Bent, Creeping Bent, Marsh Bent, or White Top; — var. *vulgaris*, with the ligule short and truncate, and the panicle after flowering more or less spreading; usually called Red Top, or Herd's-Grass (in some of the Eastern States), also Fine Bent or Fine Top. This grass in its different forms makes up a considerable part of the permanent pastures of the older States, and Red Top is sometimes sown for hay; on account of its fine close turf it is one of the best lawn grasses, especially in light sandy soils.

3. **A. verticillata**, Vill. Culms 1 or 2 feet high, decumbent and taking root below, several of the lower nodes geniculate: leaves short, flat, 1 to 3 lines wide, roughened, especially on the upper surface and margins; ligule 1 or 2 lines long, truncate; sheaths loose, shorter than the internodes: panicle 2 to 6 inches long or more, dense, lobed and interrupted; rays crowded, branched and flower-bearing from the base: spikelets scarcely a line long, often purplish: glumes about equal, acute, 1-nerved and roughened with minute pubescence, often open: floret about half the length of the glumes; lower palet 5-nerved and minutely 5-toothed at its obtuse apex, the nerves often indistinct below; upper palet nearly as long as the lower. — Trin. Spec. Gram. i, t. 36, and Agrost. ii. 112. *Vilfa stolonifera*, Hook. & Arn. Bot. Beechey, 161, probably.

San Francisco, Santa Barbara, and other localities along the coast; common in Texas, New Mexico and Northern Mexico, and found also in Southern Europe and Asia. A widely distributed species, sometimes with a regularly lobed panicle nearly a foot long, but more frequently with a shorter and much interrupted one, the lower part of the axis having naked spaces of an inch. The panicle is sometimes purplish. Found in moist places, especially near water-courses, and of no agricultural value.

++ ++ *Panicle short, dense and spike-like.*

4. **A. mucronata**, Presl. Culms in tufts from an annual fibrous and pubescent root, 3 to 9 inches high: leaves mostly flat, slightly rigid, erect, the uppermost about an inch long, the lower longer, about a line wide and slightly roughened on the margins; ligule obtuse or truncate, decurrent; sheaths longer than the internodes, very loose, crowded at the base, smooth: panicle 1 to 1½ inches long and 2 to 3 lines in diameter, at length exserted from the upper sheath; rays in crowded fascicles, appressed, and like the common axis scabrous: spikelets rather exceeding a line in length, on pedicels as long or shorter, very pale, occasionally purplish: glumes very acute and mucronate, the lower barely longer, hispid on the back and very minutely scabrous throughout: floret nearly equalling the glumes, the minute callus smooth; lower palet minutely pubescent, obtuse with four minute teeth, the midnerve excurrent just below the apex as a short rather stout rough awn, barely exserted beyond the points of the glumes; upper palet nearly half the length of the lower, extremely delicate: stamens 3, linear-oblong. — Rel. Hænk. i. 238; Trin. Agrost. ii. 106.

Sea-coast, Mendocino County, *Bolander*. This agrees very well with Presl's description of a grass in Hænke's collection, the locality for which is not given. Apparently an annual, which makes its growth of foliage in autumn, as the stems are thickly clothed below with withered sheaths. The specimens have the half-blanched appearance often presented by sea-side plants. The scabrous pubescence of the glumes and lower palet is so minute that it can only be seen with a strong glass. No one except Mr. Bolander appears to have met with this species, and he collected at the same time what is apparently a much weather-worn awnless form of it, but it is too imperfect for satisfactory determination.

+ + *Upper palet present, scarcely longer than the ovary.*

5. **A. Scouleri**, Trin. Culm strict, a foot high or more, from a perennial root, somewhat rigid: leaves 3 or 4 inches long, the uppermost 1 to 1½ inches, flat or involute, 1½ lines wide, tapering to a long point, minutely roughened above; ligule about a line long, obtuse, often lacerate; sheaths longer than the internodes, smooth: panicle long-exserted, lanceolate, open and few-flowered, the lower rays over an inch long and equalling the intervening spaces, clustered, the longer few-flowered above the middle: spikelets barely exceeding a line, very pale or tinged with purple:

glumes acute, the lower a little longer and aculeate-roughened for the whole length of its midnerve, while the upper is only so at the tip: floret but little shorter than the glumes; lower palet 5-nerved, entire and somewhat truncate at apex, the upper hyaline, exceedingly minute. — Agrost. ii. 83.

Collected by *Bolander*, but no locality given; also by *Lemmon* in the Sierra Nevada. The original specimens were from Nutka Sound. This is referred as above from the description only. The pale rather rigid foliage and culms, and the long narrow open panicle give it a distinct appearance.

6. **A. exarata,** Trin. Culm erect, 1 or 2 feet high or more, from a perennial (or annual?) root, at length naked for some distance below the panicle: leaves mostly erect and flat, 1 to 3 lines broad, the radical 2 to 4 and those of the culm 6 inches long or more, roughish or very rough; ligule obtuse, more or less decurrent; sheaths longer than the internodes, usually smooth: panicle erect, rather narrow, dense to very dense and crowded and somewhat lobed, pale greenish, rarely tinged with purple; rays 3 to 5, semiverticillate, rough, mostly flower-bearing to the base: spikelets $1\frac{1}{2}$ to 2 lines long: glumes nearly equal, the lower a little longer, toothed on the keel, acute: lower palet $\frac{1}{3}$ or $\frac{1}{2}$ shorter than the glume, somewhat acute, 4 – 5-nerved and marked on the back by a longitudinal furrow, sometimes awned above the middle; upper palet usually shorter than the ovary, sometimes longer: stamens 3; anthers oblong. — Gram. Spec. i, t. 27, and Agrost. ii. 87. *A. albicans,* Buckl. Proc. Acad. Philad. 1862, 91. *Polypogon alopecuroides,* Buckl. l. c. 88.

Occurs in its various forms in all the collections made in the State, ranging from Sitka to California and eastward to Colorado and New Mexico. No other grass found upon the coast presents such a variety of puzzling disguises as this. Specimens from wet grounds are 3 or 4 feet high, while those from dry mountain sides are only as many inches. The panicle, sometimes nearly a foot long, is usually very dense, but in some specimens the rays are spreading, and it is not rare to find it interrupted below. The leaves, usually flat, are in dry mountain localities narrow and involute, and vary strikingly in their roughness. The usually pale green of the panicle, with a slightly satiny lustre, has sometimes a strong purplish tinge. The presence of awns is more common in the dwarf forms, though not confined to them, and the larger upper palet does not appear to be associated with any other character. The specific name was given with reference to a slight groove upon the back of the lower palet, but it is far from constant, and the palet often has five nerves. Mr. Bolander states, in the Transactions of the State Agricultural Society for 1864 – 65, that the root is annual, but in some of the specimens it has every appearance of being perennial. The following, described as species, are apparently forms of *A. exarata:* —

A. grandis, Trin. (Agrost. ii. 70), described from a very large panicle only.

A. asperifolia, Trin. (l. c. 71), with exceedingly rough leaves. The specimens referred to this have very broad as well as narrow leaves, and have the awn present or absent; there are a few very minute hairs at the base of the floret.

A. pallens, Trin. (l. c. 82), is a strict form with usually narrow and sometimes involute leaves, and a rather loose panicle, which is very pale with little trace of green, but specimens occur like it in all respects except in having the panicle strongly tinged with purple.

A. Californica, Trin. (l. c. 113), may be a form of this; at least the specimens which Mr. Bolander thought might belong to this species are *A. exarata* with a much interrupted panicle.

A. microphylla, Steud. (Torr. in Pacif. R. Rep. iv. 154; *A. exarata,* var., Watson, Bot. King Exp. 377), is a small long-awned form, which we should hesitate to refer to *A. exarata* had not Mr. Bolander traced it in the living plant from 3 to 6 inches high, through a regular series, up to the large awned specimens that undoubtedly belong there.

+ + + *Upper palet entirely wanting, or present as a barely manifest hyaline scale.* — TRICHODIUM. (*Trichodium,* Michx.)

++ *Spikelets awnless.*

7. **A. varians,** Trin. Culm slender, erect, from a fibrous (perennial?) root, smooth, 3 to 6 inches high: leaves very narrow, often involute, slightly scabrous above, the uppermost on the culm about an inch long; upper ligule about $\frac{1}{2}$ line long, acutish; sheaths longer than the internodes: panicle 1 to 2 inches long, blackish purple, the rays an inch long, erect or somewhat spreading: spikelets a line long or less: glumes nearly equal, roughish on the keel toward the apex: floret a little shorter than the glumes. — Agrost. ii. 68.

On the Upper Tuolumne, at 10,000 feet altitude, and Mount Dana (*Bolander*); Calaveras Grove, *Hillebrand.* The specimens from these localities, differing in the panicle, which is spreading in some and narrow in others, all agree with the Rocky Mountain specimens ("Rocky Mts., 217 Hooker") in Herb. Torr., which Trinius quotes as the original of the species. According to Trinius the upper palet is sometimes present.

8. **A. elata**, Trin. Culm erect from a perennial root, rather stout, 2 or 3 feet high, smooth: radical leaves 4 to 6 inches long, very narrow, those below becoming involute, the upper ones flat, 3 to 6 inches long and 1 or 2 lines wide, scabrous especially below; ligules long, the upper 2 to 3 lines, acuminate; sheaths nearly smooth: panicle spreading, elongated (6 to 9 inches), green or purplish, the rays scabrous, about 2½ inches long, in clusters of 5 to 7 below and in pairs above, at intervals on the axis of about 2 inches, branching above the middle: spikelets 1½ lines long, somewhat crowded on the branches, on pedicels shorter than or twice their own length: glumes very acute, strongly roughened on the keel, the lower slightly longer and a little exceeding the floret: lower palet with a few very minute hairs at base, obtuse; upper palet wanting. — Agrost. ii. 71; Gray, Manual, 611. *A. vulgaris*, Bol. Cat. 34.

Yosemite Valley (*Bolander*, n. 6103); near Wahoe Lake, Nevada, *Dr. Torrey.* On the Atlantic coast from New Jersey southward.

++ ++ *Spikelets awnless or short-awned.*

9. **A. scabra**, Willd. (Hair-Grass. Fly-away-Grass.) Culm slender, erect, 1 to 2 feet high: leaves short and narrow, mostly involute, the radical very slender, the uppermost 1 to 3 inches long, scabrous; ligule of the upper leaves nearly a line long, the lower short; sheaths slightly roughened: panicle mostly purplish, very loose, 6 to 12 inches long or more; lower rays in clusters of 6 or more, the uppermost in pairs, all rough with minute bristles while the common axis is smooth, capillary, branched above the middle, the subdivisions flower-bearing toward the summit: spikelets a line long, mostly on longer pedicels: glumes unequal, the lower longer, very acute, scabrous and often greenish on the keel: lower palet shorter than the glumes, very thin, sometimes short-awned, the upper when present very minute. — *Trichodium laxiflorum*, Michx. Flora, i. 42, t. 8. *A. laxiflora*, Rich.; Kunth, Gram. t. 130. *A. Michauxii*, Trin. Agrost. ii. 79. *A. scabriuscula*, Buckl. Proc. Acad. Philad. 1862, 90.

Occurs in all the collections, being common, and extending northward to Alaska, as well as quite across the continent from east to west; also in Siberia. This, which is probably a biennial, when young has its long rays erect and appressed, presenting a very different appearance from the mature plant with the panicle fully developed and the branches divergently spreading; when ripe the panicles break away and are blown to long distances.

++ ++ ++ *Spikelet awned.*

10. **A. canina**, Linn. (Brown Bent-Grass.) Culms 6 to 24 inches high, sometimes stoloniferous: radical leaves involute-setaceous, those of the culm flat, a line broad or less; ligule obtuse; sheath mostly longer than the internodes, smooth: panicle 2 to 6 inches long, spreading, the unequal rays in clusters of five below, in pairs or solitary above, roughened, branching above the middle: spikelets purple or brownish, 1 to 1½ lines long, on shorter or longer pedicels: glumes slightly unequal, very acute: lower palet one-third shorter than the glumes, bearing on the back at or below the middle a more or less exserted and bent awn; upper palet wanting or very small. — Reichenb. Icon. Fl. Germ. i. 8, t. 74.

Mendocino County (*Bolander*), and northward to Oregon and Alaska. A perennial species found in nearly every part of the world and, especially the mountain forms, with many synonyms. Of little or no agricultural value.

11. **A. virescens**, HBK. Culm 1 to 2 feet high or more, perennial: leaves erect, flat, about 6 inches long and 4 lines broad, rough on both sides; ligule over a line long, truncate; sheaths much shorter than the internodes, mostly smooth:

panicle pale greenish and tinged with purple, about 6 inches long and 1½ broad, the rays in clusters about an inch distant on the common axis, the two or three longest flower-bearing above the middle, the others for their whole length: spikelets 2 lines long: glumes very acute, the lower somewhat longer and terminated by a distinct seta exceeding ½ line in length, rough on the keel and puberulent all over: floret about ½ shorter than the glumes, bearded at base with a few short white hairs: lower palet truncate, 5-nerved, the lateral nerves projecting as distinct teeth, the central excurrent at or below the middle as a strong bent awn about 2 lines long; upper palet wanting, or present as a very minute rudimentary scale. — Nov. Gen. i. 135; Trin. Agrost. ii. 74.

California, locality not given (*Bolander*); Mexico. The specimens were received from Mr. Bolander ticketed "*A. viridis*, fide Munro": as there is no such published species, *A. virescens* was probably intended, with the description of which it fairly accords. It has the general aspect as to foliage of the larger forms of *A. exarata*, Trin., but the panicle is broader and looser than in any form of that. It also differs in its bristle-pointed glumes (an exception in the genus), and its strongly truncate distinctly toothed palet, and (from the awned forms) in the stouter awn placed at the middle of the palet.

12. **A. exigua.** Annual; culm (including panicle) 1 to 4 inches high, erect, flattened, very slightly scabrous toward the nodes, sometimes branching from near the base: leaves from an inch to 2 lines long or less, those upon the branches sometimes with the blade reduced to a mere point, mostly convolute, roughened on both sides and margins, especially near the apex; ligule about a line long, acute; sheaths very loose, strongly striate and minutely scabrous: panicle half the length of the plant, included and at first narrow, at length open; lower rays about five, the others in pairs, the longer about an inch in length, bearing one to five flowers above the middle, scabrous: spikelets three-fourths of a line long, the pedicels much enlarged just below: glumes not pointed, the lower slightly longer, aculeolate on the keel and with minute scattered hairs all over, especially at the apex, generally tinged with purple: floret of but one palet, equalling the glumes, the callus very minute, with a few hairs; palet 5-nerved, scabrous with few very minute hairs, very acute at apex, the midnerve prolonged into a roughish awn four lines longer than itself, inserted about one-fifth below the tip of the palet, which is split down to that point forming two setæ; upper palet not manifest or a mere scale: stamens 1 (?).

Foot-hills of the Sierras, *Bolander*. The specimens accompanied a much reduced form of *A. exarata*, from which it is abundantly distinct, as it also is from *A. canina*.

19. GASTRIDIUM, Beauv. Nit-Grass.

Panicle contracted into a somewhat loose tapering spike. Spikelets 1-flowered. Glumes with an enlarged ventricose shining base, very acute above, obscurely keeled, the lower longer. Floret less than one-fourth the length of the lower glume, having a very short callus, which is clothed with minute hairs. Lower palet very thin, truncate and dentate at apex, just below which is a very slender awn equalling or exceeding the glumes (or sometimes absent); upper palet equalling the lower. Scales 2, linear, as long as the ovary. Stamens 3. Stigmas 2, subsessile.

A genus of a single annual species, considered by some a section of *Agrostis*, from which it differs mainly in the enlarged shining base of the glumes.

1. **G. australe,** Beauv. Culm 6 inches to 2 feet high, smooth, branching at the lower nodes, geniculate below, as are the branches: leaves flat, 2 to 5 inches long, about 2 lines wide, long-pointed, scabrous on both sides, pale green; sheaths mostly rather shorter than the internodes, slightly roughened; ligule 2 lines long, lacerate-fringed: panicle 3 to 6 inches in length and about half an inch wide, in large specimens somewhat lobed, very pale green, shining with a satiny lustre: spikelets about 2 lines long, very acute, the glumes slightly scabrous above, shining below: lower

palet hairy. — Beauv. Agrost. 21, t. 6, fig. 6. *G. lendigerum*, Gaudin; Reichenb. Icon. Fl. Germ. i, t. 73.

San Francisco (*Bolander*); San Diego County, *Palmer*. Common in Europe and the Mediterranean region; also found in Chili. This rather handsome grass is very common on the coast and, according to Mr. Bolander, late in the season covers the dry hills everywhere. Of no recognized agricultural value; animals on the continent of Europe are said to eat it.

20. CINNA, Linn. Wood Reed-Grass.

Panicle open, flexuose with spreading rays, or narrow with rigid erect branches. Spikelets 1-flowered, more or less flattened. Glumes lanceolate, acute, 1-nerved, the lower shorter, the upper equalling or slightly longer than the floret. Floret with a manifest callus, or even stipitate within the glumes. Palets similar in texture to the glumes, the lower 3-nerved, acute and awnless, or bearing a short awn or seta just below the apex, the upper indistinctly 2-nerved, or with the nerves confluent and apparently 1-nerved, slightly shorter. Scales 2, very short. Stamens 1 to 3. Ovary oblong, smooth: styles 2, elongated; stigmas plumose. Grain linear-oblong, free.

A small genus of perennials, formerly including several species now placed in *Muhlenbergia*.

1. **C. arundinacea**, Linn., var. **pendula**, Gray. Culm 2 to 6 feet high, smooth, with conspicuous brownish nodes: leaves flat, lanceolate, 4 to 8 lines broad, rough on both sides and margins; ligules conspicuous, 2 to 4 lines long; sheaths shorter than the internodes, smooth or slightly roughened: panicle 8 to 12 inches long, drooping at apex, the capillary rays clustered, distant, flexuose, very unequal, the longer flower-bearing above the middle, very scabrous: spikelets about 1½ lines long, pale green, strongly flattened: glumes very acute, pubescent, ciliate-hispid on the keel: lower palet minutely hairy, especially on the nerves, the terminal mucro distinct or quite wanting in the same specimen; stipe very distinct with sometimes a minute rudiment: stamen solitary, opposite the upper palet. — Manual, 2 ed. 545. *C. pendula*, Trin. Agrost. ii. 34. *Muhlenbergia pendula*, Bong. Veg. Sitch. 172. *Blyttia suaveolens*, Fries. *C. latifolia*, Griseb. in Ledeb. Flor. Ross. iv. 435.

Big Tree Grove (*Bolander*); Oregon and Washington Territory (*Lyall, Hall*); and north to Sitka. Eastward it is found in the northern border States and in the mountains southward, and it also belongs to northern Europe and Japan. The rarer typical form, ranging from Canada to Louisiana, has not thus far been detected within the State. It has a much denser and narrower panicle, longer spikelets (sometimes 3 lines), and is often tinged with purple. The type and variety have a rather pleasant scent, but neither appears to be sought after by cattle.

2. **C. macroura**, Kunth. Culm 3 or 4 feet high, erect and rigid, smooth or slightly pubescent below the nodes, clothed below with broken and withered sheaths: leaves narrow, convolute and attenuate at apex, rough-pubescent, the lower 3 to 4 and the uppermost 1 to 2 inches long, all very rigid; ligule 2 or 3 lines long; sheaths much longer than the internodes, loose, rough: panicle 1 or 2 feet long, erect, very narrow, dense and tapering above, loose and interrupted below, the base sometimes included; rays fascicled, very unequal, the longer (1 to 4 inches long) flower-bearing above, the shorter for their whole length; all, with the common axis, more or less roughened: spikelets 1½ to 2 lines long, scarcely compressed, minutely scabrous-pubescent and on rough pedicels about their own length: glumes acute at apex or blunt with a minute point, the lower somewhat longer and indistinctly 3-nerved: floret usually somewhat exceeding the glumes, with a brief and minutely hairy callus; palets very delicate in texture, the lower minutely pubescent, more or less acute, 3-nerved, broad and involving the very thin distinctly 2-nerved upper one, which is about the same length: stamens 3, with linear anthers. — Gram. i. 67; Trin. Agrost. ii. 36. *Crypsis macroura*, HBK. Nov. Gen. i. 140. *Vilfa rigens*, of Bolander's distribution, not Trin.

Tulare Valley (*Blake*); Deer Creek Cañon (*Brewer*); Sonora (*Bolander*); San Diego County, *Palmer*. Also in Mexico, and eastward in New Mexico and Western Texas. A very rigid wiry grass, of a pale yellowish green color throughout, growing in subalkaline localities and apparently in tufts, but the specimens generally lack the root. In general appearance it has little in common with the preceding but much the aspect of a *Vilfa*, from which its very brief callus is the chief character that separates it. The ligule is described by Kunth as being an inch long; neither in the specimen examined by Trinius, nor in those above cited does it exceed one-fourth that length. The rigid stems are used by the Indians for making baskets.

21. MUHLENBERGIA, Trin. Drop-seed Grass.

Panicle contracted, or open with spreading rays. Spikelets 1-flowered. Glumes mostly shorter than the floret, often very small, the lower usually smaller, persistent, obtuse and toothed, or acute and bristle-pointed; the lower 1- the upper rarely 3-nerved. Floret deciduous, with a minute callus or sessile, usually bearded at base. Lower palet herbaceous, 3-nerved, mucronate or awned at the apex; the upper equal or somewhat shorter. Scales 2, very small. Stamens 3. Ovary oblong, smooth: styles 2, plumose on the upper half. Grain lance-oblong, dropping inclosed in the palets.

The genus includes about 50 species, mostly American, of which 8 belong to the States east of the Mississippi; they are more numerous in Texas and in Mexico.

1. **M. gracilis**, Trin. Culms from a perennial tuft, erect, rigid, clothed below with withered sheaths, from 6 inches to 2 feet high: leaves half a line wide or less, 2 to 4 inches long, mostly convolute and filiform, scabrous, and with the whole plant very pale; ligule a line long or more; sheaths longer than the internodes, roughish: panicle 3 to 6 inches long, often bronzed or blackish, very narrow, the erect rays mostly solitary and floriferous for nearly their whole length: spikelets pedicelled or sessile, about 2 lines long exclusive of awn: glumes very variable, the lower usually a little shorter, 1-nerved and more or less acute; the upper about half the length of the floret, 3-nerved, obtuse, erose at apex or with several teeth, some of which terminate in short awns: lower palet with a short-bearded minute callus, pubescent especially on the midnerve and margins for a portion or the whole of its length and often thickly marked with blackish green spots, terminated by a slender roughish awn 4 to 9 lines long. — Agrost. ii. 56. *Podosemum gracile* and *P. quadridentatum*, HBK. Nov. Gen. i. 130, 131, t. 682, 683. *Calycodon montanum*, Nutt. Pl. Gamb. 186.

Yosemite Valley (*Bolander*); Lassen's Peak (*Mrs. R. M. Austin*); Colorado and southward to Arizona and Mexico. Very variable in stature and foliage, and especially in the glumes, which sometimes present curiously cut forms.

2. **M. pungens**, Thurber. Somewhat resembling the preceding, but the very pale green foliage hard and rigid, each leaf terminated by a hardened point: culms 1 to 1½ feet high: panicle very open, its solitary rays fasciculately branched just above the base into long 1-flowered divisions: spikelets, including the awn, 2½ lines long: glumes half as long as the floret, pointed by a distinct bristle: floret with a very minute rudiment (sometimes developed into an imperfect floret); lower palet acute, the awn a line long or less; upper palet with 2 setose teeth, which nearly equalling the awn give the appearance of an undeveloped *Aristida*. — Proc. Philad. Acad. 1863, 78.

On the Colorado River, above Fort Yuma (*Newberry*), and eastward through Arizona and Southern Utah; also in Nebraska. According to C. J. Croft (Proc. Calif. Acad. iii. 205), it is regarded in Arizona as most valuable forage, under the names of Black Grama and Grama China.

3. **M. debilis**, Trin. Culms 3 to 18 inches high, ascending from a geniculate base, branching from the lower nodes: leaves mostly flat, 1 to 2 inches long, about ⅓ line wide, acuminate, puberulent on both surfaces and with the whole plant purple

tinged or dark purple throughout; ligule nearly a line long, lacerate; sheaths somewhat inflated: panicle 2 to 6 inches long, the few mostly solitary rays spreading, distant, a little longer than the interspaces, included below by the upper sheath: spikelet 1 to 1½ lines long; floret very early deciduous: glumes ¼ to ⅓ its length, equal or the lower slightly shorter, the upper or both eroded at the obtuse or truncate apex, hyaline: lower palet scabrous throughout, terminated by a slender awn 1 to 1½ inches long; upper palet equal or slightly the shorter. — Agrost. ii. 49. *M. purpurea*, Nutt. Plant. Gamb. 186. *Podosæmum debile* and *P. setosum*, HBK. l. c. 128, 129, t. 681.

Southern California, from Santa Barbara to Northern Mexico, and eastward to the valley of the Rio Grande. A very slender annual, which is often of a deep purple color throughout. The florets drop very early and it is often collected with only the persistent minute colorless glumes, when it presents a very different appearance from the plant when its long slender-awned florets are present.

22. VASEYA, Thurb. Vaseya.

Panicle dense, sometimes interrupted below. Spikelets 1-flowered, herbaceo-membranaceous. Glumes 1-nerved. Floret equalling the glumes, with an oblique callus bearing hairs as long as the floret. Lower palet 3-nerved, terminating in a slender awn; the upper equalling it and acute. Stamens 3. Ovary stipitate: styles long; stigma of simple hairs. — Proc. Philad. Acad. 1863, 79.

But one species at present known, a perennial, with the aspect of a *Muhlenbergia* or of a *Polypogon*, while it resembles a *Calamagrostis* in the long hairs around the floret.

1. **V. comata,** Thurber, l. c. Culms 1 to 3 feet high, smooth, except at the nodes where they are retrorsely pubescent: leaves (about 6) flat, 4 to 6 inches long, 2 to 3 lines wide, dull green and roughish on both sides; ligule a short lacerate fringe; sheaths slightly roughened, the lower equalling, the upper somewhat shorter than the internodes: panicle 3 to 4 inches long, pale green, lead-colored or purplish, either narrow throughout or lobed below, the lower rays two or three together, the upper solitary, all very densely many-flowered: spikelets on very short pedicels, flattened, pubescent, a line and a half long: glumes narrow, very acute, the lower a little the longer, serrulate on the keel: awn 3 to 4 lines long, flexuose, rough, often purplish. — Watson, Bot. King Exp. 378.

Yosemite Valley and Mono Lake (*Bolander*); Huntington Valley, Nevada (*Watson*); Nebraska (*Hall & Harbour*); Colorado, *Wolf*. First described from Nebraska specimens, which are much less luxuriant than those since collected in California, the very narrow lead-colored panicles of the first presenting a very different aspect from the broader purplish inflorescence of the latter. Such an unusually leafy species may be worth a trial under cultivation. Mature specimens are still desired.

23. CALAMAGROSTIS, Adans. Reed Bent-Grass.

Panicle either open and spreading or contracted and spike-like. Spikelets 1-flowered, and mostly with a bristle-like bearded (or naked) rudiment of a second flower: glumes usually nearly equal, concave, acute, unawned. Floret shorter than the glumes, sessile or pedicelled, surrounded by usually copious white silky hairs at base. Palets thin, the lower 3–5-nerved, mostly truncate and sometimes toothed at the apex, and bearing on the back, below the tip, a slender usually bent and twisted awn, or rarely awnless; upper palet much shorter, or sometimes equalling the upper. Stamens 3. Scales 2, acute. Ovary smooth: styles distinct and short, with feathery stigmas. Grain inclosed but not adherent to the palets. — Perennials with running rootstocks and mostly tall erect and rigid culms.

There are about 60 species, widely distributed throughout the temperate parts of the globe. All of the species here given belong to the section *Deyeuxia*, which includes those having the

rudiment of a second floret. Some botanists give this section the rank of a genus, leaving in *Calamagrostis* only the species in which the rudiment is lacking. While none of the species are cultivated as pasture or meadow grasses, *C. Canadensis* is of considerable agricultural importance, as it forms a large share of the "wild hay" cut upon the western prairies. *C. arenaria*, Roth, with very large (½ inch) spikelets crowded in a dense cylindrical spike, though abundant upon both shores of the Atlantic, does not appear to have been found upon the western coast. In some parts of Europe and on the New England coast, it has been planted to restrain blowing sands, its tough rootstocks extending for 20 or 30 feet and binding the sand very effectively. It is a coarse rigid grass and distasteful to cattle except when very young. Some European botanists refer it to *Psamma*, Beauv., and others to *Ammophila*, Host.

Panicle loose and open, the spikelets mostly tinged with purple.
- Hairs of the hyaline lower palet copious, about equalling it or sometimes a little shorter.
  - Spikelets less than 2 lines long. — 1. C. CANADENSIS.
  - Spikelets 2 lines long or more. — 2. C. LANGSDORFFII.
- Hairs copious and one-third to one-half shorter than the palet. — 3. C. DESCHAMPSIOIDES.
- Hairs scanty, less than one-fourth the length of the palet.
  - Plant tall (2 to 3 feet). Leaves ample and flat. — 4. C. BOLANDERI.
  - Plant dwarf (6 to 15 inches). Leaves convolute-setaceous. — 5. C. BREWERI.

Panicle strict and narrow, its short branches erect and appressed after flowering; lower palet membranaceous, sometimes of similar texture to the glumes.
- Hairs at base of the floret nearly equalling or about one-third shorter than the palet and exceeded by those of the rudiment.
  - Spikelets 2 to 2½ lines long. Glumes very thick. — 6. C. CRASSIGLUMIS.
  - Spikelets 1¼ lines long. — 7. C. STRICTA.
- Hairs short, barely half as long as the palet.
  - Awn from below the middle of the palet and but little exceeding it. — 8. C. ALEUTICA.
  - Awn from near the base of the palet and long-exserted. — 9. C. SYLVATICA.

* *Panicle loose and open, mostly tinged with purple.*

1. **C. Canadensis,** Beauv. Culms tall, erect, smooth, 3 to 5 feet high, rarely branching below: leaves about a foot long, 2 to 4 lines wide, flat, minutely scabrous: ligule short, lacerate; sheaths closely appressed, shorter than the internodes, smooth or slightly roughened: panicle 4 to 6 inches long, oblong, the common axis and rays scabrous: spikelets from 1¼ to 1¾ lines long: glumes lanceolate, acute: lower palet nearly as long, obtuse and more or less 2-toothed at the apex, surrounded by copious white hairs, and awned on the back from near the middle with a very delicate bristle not much stouter than the hairs, and usually barely equalling or rarely slightly exceeding the palet; upper palet a little shorter: rudiment very minute. — Torrey, Fl. N. York, ii. 444, t. 150; Gray, Proc. Amer. Acad. iv. 77, and Man. 615, t. 8. *Arundo Canadensis*, Michx. Fl. i. 73. *C. Mexicana*, Nutt. Gen. i. 46, excl. syn. Pers. *Cinna* (?) *Purshii*, Kunth, Enum. i. 208.

Moist places, mostly in the Sierra Nevada (*Hillebrand, Bolander*), to Oregon (*Howell*), and British Columbia, and from subarctic America to Pennsylvania and New Mexico. In the older States, where this grass is abundant, it is known by the not very descriptive name of "Blue Joint," and is regarded as a valuable meadow grass, though it is encouraged rather than cultivated. By some the hay is considered nearly as nutritious as that from Timothy (*Phleum pratense*). Large quantities are cut on the prairies, it yielding in rich soil very heavy crops.

2. **C. Langsdorffii,** Trin. Culm, leaves and panicle as in *C. Canadensis:* spikelets 2 to 3 lines long: glumes lanceolate or oblong-lanceolate, attenuate-acuminate, often cinereously strigose-pubescent: awn stouter than in the preceding and often slightly exceeding the palet. — Gram. Uni-Sesquifl. 225; Gray, Proc. Amer. Acad. iv. 77. *C. Oregonensis*, Buckl. in Proc. Phil. Acad. 1862, 92, in part; Gray, same, 334.

Calaveras County (*Hillebrand*); Oregon (*Tolmie, Nuttall*), and northward to Arctic America. Found also in the White Mountains of New Hampshire, the Rocky Mountains, and in the northern regions of both continents. Liable to be confounded with *C. Canadensis*, from which it is mainly distinguished by its longer and more acute glumes and its stouter and (usually) exserted awn. In the Californian specimens the glumes barely exceed two lines long, being precisely like the Oregon specimens of Nuttall (*C. Columbiensis*, Nutt. in herb.), which Dr. Gray (Revision of

the *Deyeuxia* section of the genus, l. c.) refers to this species. The panicle is light brown or darker purplish-brown, sometimes purplish. In both cases the awn exceeds the palet by nearly a line and is attached about one-third below the tip.

3. **C. deschampsioides,** Trin. Culms tufted, erect from a decumbent base, which is thickly covered by withered remains of sheaths, 5 to 10 inches high, smooth, half equalled by the basal leaves: culm leaves 1 to 2 inches long, loosely convolute, smooth, the uppermost erect, smaller; ligule about a line long, split; sheaths as long as the internodes, smooth: panicle ovate, 1 to 1½ inches long, open, few-flowered; rays in pairs or ternate, divided above the middle and bearing about 5 flowers, and with the rhachis smooth: spikelets 2 lines long, more or less purple-tinged: glumes equal, broadly lanceolate, acute, as long as or barely equalling the floret: lower palet nearly smooth, membranaceous, lacerate-toothed at apex, slightly scabrous on the nerves, bearing at or below the middle a stout somewhat divergent awn which is exserted about one-third the length of the palet; hairs at base delicate, fairly copious, one-half to two-thirds its length; upper palet quite equalling and similar in texture to the other, 2-nerved and irregularly 2-toothed: rudiment a brief process, scarcely one-fifth the length of the palet and naked, or somewhat longer with very short hairs. — Trin. Spec. Gram. iii; t. 354; Griseb. in Ledeb. Flor. Ross, iv. 427. *C. rubescens,* Buckl. in Proc. Phil. Acad. 1862, 92 (*l*); Gray, in same, 334.

Alaska and Arctic Asia, but not certainly found within our territory. The plant called *C. rubescens* by Buckley is doubtfully referred here by Gray, of which only an imperfect fragment is found in the herbarium of the Philadelphia Academy, said to have been collected in Oregon by Nuttall. It is a species likely to occur, and from its close resemblance in habit to *C. Breweri* might readily be confounded with that species. In our northern specimens the rudiment is no more than barbellate, but Trinius's figure gives it as distinctly though not copiously plumose.

4. **C. Bolanderi.** More or less scabrous throughout: culm 2 to 3 feet high, geniculate: leaves flat, 6 to 10 inches long, 2 to 4 lines wide, the uppermost a half smaller, pale yellowish-green: ligule about 2 lines long, truncate, erose or lacerate; sheaths scarcely half as long as the internodes, rather loose: panicle 3 to 8 inches long, loose, blackish purple, becoming brownish; rays in threes and fives, very slender, rather erect, at length spreading or even deflexed, the branches few-flowered above the middle: spikelets 1½ lines long on longer pedicels: glumes equal, lanceolate, acutish, minutely hairy, rough on the keel, the margins above minutely ciliate: floret barely shorter; lower palet minutely rough-tuberculate, often bifid, the lateral nerves slightly excurrent; hairs at base few and unequal, short, mostly at the sides; awn attached nearly at base, the lower half twisted and lodged in a dorsal groove, divergent above and exserted just below the tips of the glumes; upper palet slightly shorter, of similar texture, broad, 2-nerved, 2-toothed, and somewhat rough-tuberculate between the nerves: rudiment half the length of the floret, with long hairs. — *C. varia* (*l*), Boland. Cat. 34.

Swamps, Mendocino County, *Bolander,* n. 6471 (in part). A strikingly handsome species; the yellowish-green color of the plant contrasted with the blackish-purple of the panicle must make it conspicuous, while a closer inspection shows the bright whiteness of the floret in strong contrast with the deep color of the glumes. The roughness of the palets is unlike anything we remember to have seen in grasses, appearing under the microscope like minute glistening grains of silex. In the specimens the groove running lengthwise of the lower palet and forming a lodgment for the awn is very distinct and well-defined; whether it remains in fruit is uncertain.

5. **C. Breweri,** Thurber. Culms densely tufted, 6 to 15 inches high, erect, very slender, bearing 2 short distant leaves: radical leaves 2 or 3 inches long, setaceously involute, minutely scabrous above; upper ligule acute, decurrent, 2 lines long, the lower lacerate; sheaths close, strongly striate: panicle loose, 1 to 3 inches long; rays solitary or clustered, divaricate or more or less erect, barely equalling the interspaces, 1–3-flowered: spikelets blackish-purple, 1½ or 2 lines long, smooth or slightly roughened above: lower palet nearly equalling the acute glumes, minutely 4-toothed, slightly roughened, more or less lined with purple, and with a small tuft of minute unequal hairs at each side; awn from above the base, exserted about a

line, little divergent; upper palet usually nearly equalling the lower, very thin, 2-nerved and mostly 2-toothed: anthers very large, dark purple or purplish: rudiment large and conspicuous, its abundant hairs nearly equalling the floret. — Bolander, Trans. Calif. Agric. Soc. 1864–65, 136.

Near summit of Carson's Pass (*Brewer*, n. 2128); on the Tuolumne, at 9,700 feet altitude (*Bolander*, n. 6098); also by *Lemmon*, locality not given. A neat well-marked species, with a strong general resemblance to *C. deschampsioides*, but differing widely in the structure of the flower.

C. STRIGOSA, Bong. (Gray, Proc. Am. Acad. iv. 78), may possibly occur in northern localities. It will be recognized by its very large glumes, 2½ to 3 lines long, terminating in a long subulate point, strigosely pubescent all over, and especially so on the keel; the floret considerably shorter; the awn attached well below the middle, exserted and about equalling the palet; hairs copious and one-third shorter than the acute palet and about equalled by those of the conspicuous rudiment. What appears to be Bongard's plant was collected in Alaska by Mr. Harrington.

* * *Panicle narrow, the erect branches appressed after flowering: lower palet sometimes like the glumes in texture.*

6. **C. crassiglumis.** Culm about a foot high, erect, rigid: radical leaves nearly as tall, culm leaves 3 or 4 inches long, divergent, the upper smaller, erect, usually reaching the panicle, all convolute, 1 or 2 lines wide, acute, rigid, strongly striate, rough above and on the margins, very pale green; ligule less than a line long, erose-toothed and cartilaginous; sheaths loose, the upper especially, mostly equalling the internodes, smooth: panicle scabrous, about 2 inches long, very dense, occasionally interrupted below, the short very rough rays appressed, densely flowered: spikelets 2 to 2½ lines long on shorter pedicels, brownish-purple above: glumes nearly equal, broadly ovate or ovate-lanceolate, rather abruptly pointed, the upper often mucronate, minutely scabrous, subcartilaginous, with thin margins: lower palet scarcely shorter, very broad, acute, lacerate-fringed and obscurely toothed at apex, scabrous, with hyaline margins, the delicate hairs two-thirds as long; awn attached just below the middle, rather stout, straight, very slightly exceeding the palet, sometimes barely exserted; upper palet thin, scarcely one-fourth shorter, 2-nerved, erose-toothed: rudiment very small, its abundant hairs about equal to the upper palet.

Swamps, Mendocino County, *Bolander*, n. 4766, 4787. Plant with the habit of *C. Lapponica*, Trin., under which name it was distributed, but very unlike in its flowers. The glumes in this are much broader and less acute, and are remarkably thick and tough. The lower palet is much broader, with fewer and shorter basal hairs; the awn is attached just below the middle of the palet, while in the other it is just above the base; the rudiment is much larger, with more copious hairs upon its whole length: in *C. Lapponica* they proceed from the apex only. The glumes, wherever exposed, are dark brownish-purple; on the back and below they are very pale green. The palets are more or less purple-tinged along the nerves.

7. **C. stricta,** Trin. Culm erect, rather rigid, 1 to 3 feet high, somewhat scabrous below the panicle: leaves narrow and mostly setaceously involute, erect, scabrous on both sides; ligule short; sheaths smooth: panicle at first included at base, at length exserted, 2 to 5 inches long, erect, narrow, somewhat lobed, interrupted below, the roughened and erect branches much crowded, flower-bearing mostly to the base: spikelets rarely exceeding 1½ lines, often blackish purple, sometimes straw-colored: glumes ovate-oblong, acute, nearly equal, rough upon the keel and minutely scabrous all over: floret very slightly shorter; lower palet roughish, bearing the straight awn at or a little below the middle and slightly exceeding it; hairs at base about two-thirds the length of the palet; upper palet hyaline, one third the shorter, 2-nerved and 2-toothed: rudiment conspicuous, its hairs about equalling the palet. — Gram. Uni-Sesquiil. 226; Gray, Proc. Am. Acad. iv. 78, and Man. 615.

Sierra County (*Lemmon*); Klamath Valley (*Cronkhite*); and frequent eastward to the Rocky Mountains and along the northern border through Wisconsin, etc., to Vermont and Canada. Andersson, in Gram. Scand., and Griesbach, in Ledeb. Flor. Ross., place *C. stricta*, Trin., as a synonym of *C. neglecta*, Gaertn. What is known to American botanists as *C. stricta* differs from authentic specimens of the European *C. neglecta* in the much firmer texture of its glumes, the more copious and longer hairs at base of floret, the somewhat stouter awn, and longer rudiment.

Varies with the leaves flat except near the apex, or all strictly convolute; very pale green. The panicle is sometimes continuous, but usually the lowest and sometimes the lower two fascicles of rays are separated by an inch or so of the naked axis; color dark brownish or blackish purple, green and dark purple, or straw-colored throughout.

8. **C. Aleutica,** Trin. Culms stout, 2 to 5 feet high, erect or subgeniculate below, smooth except at top: leaves erect, rather rigid, those of the culm flat, long-attenuate, about a foot long and 4 or 5 lines broad, rough on both sides; ligule ovate or truncate; sheaths very loose, mostly much shorter than the internodes: panicle very rough, 6 to 10 inches long, an inch wide or less, rather loose, subflexuose at top, somewhat interrupted; rays 2 inches long or less, in crowded clusters, the branches flower-bearing to the base: spikelets 2½ to 3 lines long, mostly exceeding the pedicels, pale or brownish: glumes nearly equal, lanceolate, acuminate, membranaceous, roughish all over: palets like the glumes in texture and but slightly shorter, the lower acutish, minutely 4-toothed and soon lacerate, nearly smooth, its straight or curved awn inserted just below the middle and barely as long; hairs scarcely half as long and about equalling the sparse tuft of the very minute rudiment; upper palet roughish on the two conspicuous nerves, shortly 2-toothed and ciliate at apex. — Bong. Veg. Sitch. 171; Hook. Fl. Bor.-Am. ii. 241; Griseb. in Ledeb. Fl. Ross. iv. 427; Gray, Proc. Am. Acad. iv. 80. *C. albicans,* Buckl. Proc. Acad. Philad. 1862, 92; Gray, same, 334.

San Francisco, Oakland, etc. (*Bolander*), and northward to Washington Territory and Alaska. This is the most robust species of the coast and forms dense tufts on the hillsides. The lower leaves break off near the sheath, leaving these erect and rigid. The panicle is sometimes pale straw-color, but generally more or less tinged with brownish-purple and sometimes of the bronze-color so noticeable in some species of *Aira* from the northwest coast; the palets are sometimes slightly colored also. It varies with the lower glume acuminate, considerably longer than the upper and over 3 lines long.

9. **C. sylvatica,** DC. Culms erect, rather rigid, 1 to 2 feet high, clothed at base by crowded dead sheaths: radical leaves reaching nearly to the panicle; culm leaves 3 to 8 inches long, the uppermost shorter, all less than 2 lines wide, attenuate-pointed, more or less scabrous and involute; ligule about a line long, lacerate; sheaths more or less equalling the internodes, rarely fringed at the throat, the uppermost very loose: panicle inclosed at base when young, spike-like, strict, 3 or 4 inches long, about ½ inch wide, very dense, often slightly interrupted below, pale to dark-purple throughout; rays mostly in fives, an inch long or less, appressed and like the rhachis very rough: spikelets 3 to 3½ lines long, on short roughened pedicels: glumes ovate-lanceolate, very acute, the upper distinctly 3-nerved, scabrous, a little exceeding the palets: lower palet in texture like the glumes, acute, 4-toothed, scabrous, grooved on the back; awn attached very near the base, twisted and rough below, bent at the middle and exserted more than half the length of the glumes; hairs unequal, the longest at the sides about ¼ as long as the palet; upper palet thin, hyaline, broadly 2-nerved, 2-toothed; rudiment stout, including its hairs about ⅔ the length of the palet. — Reichenb. Icon. Fl. Germ. t. 138; Griseb. in Ledeb. Flor. Ross. iv. 426; Gray, l. c.; Watson, Bot. King Exp. 379. *C. purpurascens,* R. Br., App. Richards. Voy. 3.

Mount Dana, at 12,500 feet altitude, and on the sea-coast (*Bolander*); Oregon (*Nuttall*); Humboldt Mountains, Nevada (*Watson*); Rocky Mountains of Colorado by several collectors. Also in northern and middle Europe and Siberia. All the North American specimens have a much denser and stricter panicle than any from Europe with which we have been able to compare them, though those collected in Mendocino County by Bolander (without number) approach them in this respect. The plant seems to be much more leafy at the coast than upon the mountains, the latter usually having more rigid culms and the leaves mostly involute. The Mendocino specimens also show a distinct ring of hairs at the junction of the blade and sheath, a character given for the European plant. The color of the panicle is very variable, running from greenish straw-color through various degrees of purple to deep purple all over; these differences sometimes occurring in specimens of the same set show that the purple form cannot be regarded as a variety even. Sometimes the lower sheaths are purple-tinged, and in specimens with dark-colored glumes the lower palet also partakes of this color more or less.

24. ERIOCOMA, Nutt. SILKY-GRASS.

Panicle few-flowered with spreading slender dichotomously branched rays, or very narrow with few 1 – 3-flowered erect rays. Spikelets solitary, 1-flowered. Glumes nearly equal, membranaceous, acuminate or attenuate-pointed, the lower 3-, the upper 5-nerved. Floret much shorter than the glumes, ovate, with a short distinct callus. Palets at first herbaceous, becoming coriaceous or even crustaceous, the lower much broader, involving the upper, clothed with very long white silky hairs, bearing at or just below the apex a short straight or curved obscurely triquetrous caducous awn. Scales 3, as long as the ovary. Stamens 3; anthers bearded or naked. Ovary stipitate. — *Urachne* § *Eriocoma*, Trin. & Rupr. *Fendleria*, Steud.

To this interesting genus, for a long time known only by a single widely distributed species, a second species is doubtfully referred. In both, but conspicuously so in the first, the fibres of the root are clothed with a dense covering of matted cottony hairs, which make them appear three times their real size. Perennials, forming dense tufts crowded below with the remains of the sheaths of former years; foliage very pale and rigid. Steudel founded his *Fendleria* on Fendler's n. 979, which he describes as having a second and neuter floret as a slender and very thin palet shorter than the glumes. An examination of other specimens collected under this number, and of many others from a wide range of localities, fails to discover this second floret; there is at most, as noted by Watson (l. c.), "a very short and thick process at the base of the upper palet."

1. **E. cuspidata,** Nutt. Culms 1 to 2 feet high, mostly simple, sometimes geniculate at the upper node: leaves setaceously convolute, rigid, scabrous, the radical ones often equalling the culm; cauline three, the uppermost nearly equalling the panicle or reduced to a filiform point; ligule a line long or more, acute, mostly bifid; sheaths roughish, the middle one shorter than its internode, the upper very loose: panicle at length exserted, about 6 inches long and nearly as broad, the capillary often flexuose rays mostly in pairs, the lower several times dichotomously branched, the upper branched but once, at their extremities, the branches 1-flowered: spikelets 3 or 4 lines long: glumes ventricose below, attenuate-rostrate, pubescent, colorless except the green nerves, the midnerve only extending the whole length: floret about half the length of the glumes; lower palet broadly oval, green and herbaceous when young, shorter than its long hairs, becoming hard, brown, and finally black and shining and naked, the 5 nerves confluent near the obscurely bifid apex; upper palet equal, narrow, 2-nerved, entire; awn mostly longer than the palet, nearly straight: anther-cells bearing usually 5 hairs about ⅓ their length. — Nutt. Gen. i. 40; Watson, Bot. King Exp. 379. *Stipa membranacea*, Pursh. *Stipa hymenoïdes*, Roem. & Schult. Syst. ii. 339 and Mant. 188. *Urachne lanata*, Trin. Panic. 38; Trin. & Rupr. Stipaceæ, 19. *Fendleria rhynchelytroïdes*, Steud. Syn. Gram. 420.

"From the Sierras eastward" (*Bolander*), and northward to British America; common in Nevada and Utah, at 4,000 to 8,000 feet altitude (*Watson*), extending eastward to Missouri and southward to New Mexico and Texas. A remarkably handsome grass, the regular branching of its panicle, with a few large white spikelets, making it especially noticeable. Valued by travellers as one of the several kinds of "Bunch-grass." The awn falls so soon that specimens are frequently quite awnless, but the large seeds inclosed in the hardened palets remain a long time.

2. **E. Webberi.** Culms densely tufted, 3 to 6 inches high, slender and wiry: leaves convolute, rigid, pungent at the apex, scabrous, the radical 2 to 3 inches long, numerous; culm leaves 4, the uppermost an inch long or less; upper ligules manifest, rounded, the lower obscure; lower sheaths crowded, the uppermost dilated: panicle 1 to 2½ inches long, very narrow, few flowered; rays slender, erect, the lower in threes and 1 – 3-flowered, the upper solitary, 1-flowered: glumes 4 lines long, acuminate, often purple-tinged: floret about 3 lines long, with a short callus, deciduous; lower palet (when young) herbaceous, 5-nerved, the lateral nerves arched towards and meeting the central one, apex minutely 2-lobed, covered throughout with copious silky white hairs a line long; upper palet equal and similarly hairy on the back; awn 2 lines long, very slender, roughened, curved: anthers long, naked.

Sierra Valley, *Bolander*, May, 1871. The specimens are immature, and leave it for riper materials to complete the description. Except in its very different panicle it accords well with *Eriocoma*, and it is preferred to modify the generic character rather than add a new genus. The awn in this falls even earlier than in *E. cæspitata*, and is rarely to be found except in those spikelets that are still included by the upper sheath. The collector sent this grass several years ago with a set of his species of *Stipa*, to which genus he supposed it to belong, with the request that, should it be new, it be named in honor of Dr. Webber of Sierra Valley, an esteemed physician who had aided him in his botanical explorations, and upon whose estate the grass was discovered.

25. STIPA, Linn. Feather-Grass.

Panicle open, with few spreading branches, or sometimes crowded and narrow. Spikelets 1-flowered, the cylindrical floret with an obconic bearded and often elongated sharp-pointed callus, in our species shorter than the glumes, and readily falling at maturity. Glumes subequal, membranaceous, often terminated by a long subulate point. Lower palet coriaceous, cylindrical-involute, inclosing the mostly shorter upper one, entire at the apex or terminating in two minute sometimes hyaline teeth, naked or with a crown of short hairs, conspicuously awned. Awn articulated with the palet, often caducous, geniculate below, glabrous or pubescent or plumose with spreading hairs. Scales 3. Stamens usually 3, sometimes 1 or 2; anthers often bearded at the apex. Ovary stipitate, smooth: styles 2, short; stigmas plumose with simple hairs. Grain cylindrical, smooth, free from but inclosed in the palets.

A genus of perennials, with mostly involute leaves and early deciduous florets, represented in almost every part of the world. Some of our species, under the not very distinctive name of "Bunch-grass," are among the valued kinds of forage in the Sierra Nevada. *Stipa* (*Macrochloa*, Kth.) *tenacissima*, of southern Europe and northern Africa, forms a portion of the "Esparto grass," largely used in paper-making. *S. pennata* of Europe (a variety of which occurs in Arizona) is an old garden plant, cultivated for its beautifully plumose awns; the panicles, which are 6 to 12 inches long, are imported in considerable quantities for "ornamental" purposes, usually dyed in various brilliant and unnatural colors.

* Awn for a part of its length plumose with silky hairs.

Foliage, panicle, etc., pale green.
- Lower palet 2-lobed at apex. — 1. S. SPECIOSA.
- Lower palet entire at apex. — 2. S. OCCIDENTALIS.

Foliage, panicle, etc., tawny yellow. — 3. S. CHRYSOPHYLLA.

* * Awn not plumose, often strongly pubescent.

Panicle open with spreading often secund rays, which are few-flowered above the middle.
- Awn 6 inches long; floret coarsely hairy. — 4. S. COMATA.
- Awn 3 inches or less in length.
  - Lower palet tuberculate, partially hairy. — 5. S. SETIGERA.
  - Lower palet hairy all over. — 6. S. EMINENS.

Panicle narrow, with mostly erect rays.
- Panicle small, 2 inches long; floret 2 lines long, purplish. — 7. S. KINGII.
- Panicle large, 6 inches long or more.
  - Lower palet with two distinct herbaceous teeth. — 8. S. STILLMANII.
  - Lower palet with two more or less manifest hyaline teeth.
    - Floret less than three lines long. — 9. S. SIBIRICA.
    - Floret 3 to 5 lines long.
      - Lower palet with copious long silky hairs. — 10. S. CORONATA.
      - Lower palet with short scattered hairs. — 11. S. VIRIDULA.

* *Awn for a part of its length distinctly plumose with silky hairs.*

1. **S. speciosa,** Trin. & Rupr. Culm 1 to 2 feet high: radical leaves half as long as the culm, the others much shorter and with the sheaths minutely puberulent; upper sheath inflated, its leaf about 4 inches long, its ligule less than a line long, that of the lower sheaths minute and fringed: panicle 6 to 8 inches long, included below, contracted, its appressed rays mostly in pairs and 6–8-flowered: glumes

8 or 9 lines long, nearly equal, long-acuminate and often lacerately 2-toothed at the apex, hyaline, the lower 3- and the upper 5- or indistinctly 7-nerved; floret 5 or 6 lines long, with a short callus; lower palet one-third longer than the upper, silky-pubescent throughout, slightly but distinctly 2-toothed; awn 1½ to 2 inches long, geniculate below the middle, plumose from the base nearly to the bend, with conspicuous white silky hairs 3 lines long, smooth above: anthers 3, beardless. — Stipaceæ, 45.

Near San Bernardino, *Parry & Lemmon*, n. 423 (1876). This, which does not appear to have been met with by other botanists, is a native of Chili, and is referred here from the description only. It adds a third to the plumose species in the State. It is distinguished from *S. occidentalis* by its longer and many-flowered panicle, its more pointed glumes, which are generally lacerate at the slender apex, and the more conspicuously plumed awn, the silky hairs ending abruptly below the bend, the rest of the awn being quite smooth.

2. **S. occidentalis**, Thurber. Culms slender, 1 to 2 feet high, somewhat scabrous, pubescent at the nodes: radical leaves 2 to 4 inches long, those of the culm shorter, all involute, rigid and rough; sheaths shorter than the internodes; ligule conspicuous, 2 or 3 lines long, lacerate: panicle 3 to 6 inches long, the base often included, contracted; rays mostly erect, the lower in twos or threes and few-flowered, the upper solitary and 1-flowered: lower glume 5 lines long, 5-nerved, somewhat exceeding the indistinctly 3-nerved upper one: lower palet 3 to 3½ lines long, one-fourth longer than the upper, brownish when ripe, pubescent with appressed hairs, especially below; callus short, acute, the apex with a short distinct crown of hairs; awn 1½ inches long, twice bent, and plumose to the upper geniculation with rather coarse hairs which are less than a line long below and shorter above: anthers naked. — Bot. Wilkes Exped. 483; Watson, Bot. King Exped. 380.

Common in the Sierras, extending into Oregon; also Nevada. Mr. Bolander remarks, in Proc. Calif. Acad. iv. 169, that in large specimens the awn is naked; the large specimens from him, referred to this species, belong to *S. comata*, Trin.

3. **S. chrysophylla**, E. Desv. Culms forming very dense tufts, 6 inches to 2 feet high or more, somewhat branched, and clothed below with withered sheaths: leaves half as long as the culm or more, closely and setaceously involute and rigid, slightly scabrous and with the sheaths and panicle tawny yellow; ligule short; upper sheath usually inflated: panicle contracted, mostly included below, 4 to 6 inches long, with short appressed 1–3-flowered rays: glumes about 8 lines long, nearly equal, acuminate, hyaline, 5-nerved: floret including a medium callus 4 to 5 lines long; lower palet twice the length of the upper, covered with spreading white hairs, bearing two minute lobes at the apex and an awn 1 to 1½ inches long which is bent near the middle, plumose below the bend with silky hairs 2 lines long and smooth above: anthers naked. — Gay, Flor. Chil. vi. 278, t. 76, fig. 2.

Santa Inez, near Mono Lake, and collected on Ives' Colorado Expedition; a native also of the mountains of Chili. Readily distinguished by its marked yellow color and its handsome plumose awn. Agrees well with Gay's Chilian specimens, excepting that the purple tinge of the glumes, which Desvaux gives as a character, is wanting in all of our specimens. This author makes two varieties, *minor* and *major*, the one short with the leaves equalling the culm, and the other taller with leaves half as long; our specimens show by intermediate states that the plant is very variable in this respect. Two other species with plumose awns occur beyond the borders of the State, one in New Mexico, very closely allied to *S. pennata*, Linn. (var. *Neo-Mexicana*, Thurber, in Gram. Mex. Bound. ined.), the other in the mountains of Colorado, *S. Mongolica*, Turcz.

* * *Awn not plumose, often strongly pubescent.*

+ *Panicle open with spreading, often secund, few-flowered rays.*

4. **S. comata**, Trin. & Rupr. Culms 1 to 4 feet high, stout, mostly scabrous; leaves involute, roughened, the radical ¼ or ⅓ the length of the culm, the leaves on which are much shorter, the uppermost very small or reduced to a mere sheath; ligule conspicuous, acute, 2 or 3 lines long; sheaths loose, the uppermost somewhat inflated, smooth, at length shorter than the internodes: panicle included at base by

the upper sheath, open, 8 to 12 inches long; rays ternate or in pairs, distant, few-flowered; glumes about an inch long, nearly equal, 5-nerved, with a long subulate point: floret (including callus of 2 lines) 6 lines long, readily deciduous; lower palet rather sparsely pubescent with coarse hairs, but with no distinct corona; awn 4 to 6 inches long, seldom distinctly geniculate, scabrous especially above, shining, variously curled and twisted, soon deciduous; upper palet equalling the lower: stamens 3; anthers mucronulate at apex (but not barbulate as described by Trin. & Rupr.). — Stipaceæ, 76; Watson, Bot. King Exped. 380. *S. juncea*, Nutt. Gen. i. 58, not Linn. *S. capillata*, Hook. Flor. Bor.-Am. ii. 237, not Linn. *S. occidentalis*, Bolander, Proc. Calif. Acad. iv. 169, in part.

Mono Lake (*Bolander*); Western Nevada (*Watson*); Oregon (*Spaulding*); and from the Upper Missouri to Utah, Nebraska and New Mexico. A pale green species, which presents very different aspects according to age; when young the panicle, all save its long awns, is inclosed by the upper sheath; later it is exserted, with its few rays spreading, but as its florets are early deciduous it at that time rarely has anything but empty glumes. It is very near *S. capillata*, Linn., of Europe, from which it differs in its broader leaves, longer and acute ligule, more sparsely flowered panicle, and longer and more attenuate-pointed glumes. The plant cited by Mr. Bolander as a smooth-awned *S. occidentalis* is this species with rather shorter awns than usual.

5. **S. setigera**, Presl. Culm 1 to 3 feet high, pubescent at the nodes, with radical leaves about one-third as high; culm leaves flat, 2 or 3 lines wide below, long-attenuate above, rough-pubescent and sometimes ciliate on the margins, the uppermost nearly equalling the panicle; ligule about 1 line long, truncate and split; sheaths two, pilose at throat, the lower shorter than the internode, the upper loose: panicle about 6 (sometimes 12) inches long, mostly included below, loose, flexuose, more or less secund when young, the slender rays in pairs; pedicels shorter than the spikelets: glumes 6 to 9 lines long, long-acuminate, the upper rather shorter, usually purplish, strongly 3-nerved: floret (including a callus of 1 line) 5 lines long, constricted below a distinct corona; lower palet tubercular-roughened, silky hairy especially on the nerves; upper palet hyaline, scarcely a third as long; awn 2 to 3 inches long, slender, flexuose, more or less distinctly bent above the middle, strongly pubescent below, minutely so above, persistent: anthers bearded at the apex. — Rel. Hænk. i. 226; Trin. & Rupr. Stipaceæ, 28. *S. avenacea*, Hook. & Arn. Bot. Beechey, 403, not Linn. *S. Neesiana* and *leucotricha*, Trin. & Rupr. l. c. 27 and 54; Torr. in Pacif. R. Rep. iv. 154. *S. ciliata*, Scheele in Linnæa, xxii. 342.

Common from San Diego County (*Parry*), northward to Oregon (*Hulse*); New Mexico and Texas, and in South America. A rather variable species, often with closely involute leaves. The upper glume has sometimes one or two additional nerves ("5-nerved," *Presl*); in the Californian specimens the glumes are generally purple, and in those from Texas they are scarious. The palets differ as to their pubescence, which, so far as noticed, never completely covers the surface. It is common on the Coast Ranges and on the foot-hills of the Sierra Nevada and, according to Prof. Brewer, is the most common and valuable "Bunch-Grass" of the dry hills.

6. **S. eminens**, Cav. Culms 1 to 3 feet high, slender, pubescent at the nodes: leaves all convolute-setaceous, somewhat rigid, slightly scabrous, those of the radical tufts about half as long as the culm; lower culm leaves 6 to 8, the uppermost 2 inches long; ligule very minute; sheaths striate, smooth: panicle 4 to 6 inches long, soon exserted, somewhat secund, the very slender rays short, in pairs, few-flowered: lower glume about 5 lines long, the upper 4 lines, acuminate, 3-nerved, purplish: floret a little more than half the length of the lower glume; callus less than ½ line long; corona short, but distinct; lower palet hairy throughout, the upper about one-third as long and hyaline; awn about 1 inch long, very slender, bent near the middle, minutely and evenly scabrous, readily falling away: stamen 1, small, oval. — Icon. v. 42, t. 467; Trin. & Rupr. Stipaceæ, 30.

Coast Ranges and foot-hills; also from Quito in South America. Often confused with the preceding by collectors, some slender forms of which closely resemble this. The longer floret, with more conspicuous callus and corona, the pubescence not covering the whole palea, and the much longer more pubescent and persistent awn of that species as well as the longer glumes and pilose sheaths will readily distinguish it.

+ + Panicle narrow, with more or less erect usually crowded rays.

++ Lower palet less than 3 lines long.

7. **S. Kingii,** Boland. l. c. Culms tufted, 6 to 20 inches high, covered below by the remains of numerous sheaths, slender, smooth, with but two nodes near the base: radical leaves half as long as or equalling the culm, setaceously involute, minutely scabrous; culm leaves 2, the upper short; ligule a line long, acute, often cleft: panicle narrow, 1 to 2 inches long, the short erect rays scabrous; lower rays ternate, 2-flowered, the upper in pairs or solitary, 1-flowered: spikelets 2 lines long: glumes obtuse, eroded and sometimes mucronate, hyaline with a tinge of purple at base, the midnerve extremely delicate, and the others not manifest; the lower glume one-fourth shorter, equalling the floret: callus short, whitish; lower palet purplish, sparsely pubescent, with a few longer hairs at tip which is very minutely 2-toothed; awn 6 lines long, bent below the middle, scabrous and very persistent; upper palet equalling the lower and hairy at apex: anthers bearded at tip.

Mount Dana, at 7,000 to 12,000 feet altitude, *Bolander.* This exceedingly neat and delicate species is named in honor of Mr. Clarence King.

8. **S. Sibirica,** Lam. Culms 1½ to 3 feet high, clothed at base by the remains of old sheaths: leaves very narrow and involute, smooth or slightly roughened, the radical about half equalling the culm; ligule short; sheaths shorter than the internodes, the upper somewhat inflated, its blade about half as long as the panicle, pale green throughout: panicle 6 to 12 inches long, erect, narrow; rays distant, the lower in threes or fives, the upper in pairs, branching and few-flowered: spikelets 4 lines long: glumes nearly equal, acuminate in a slender point, 3-nerved, minutely scabrous and one-fourth longer than the fusiform short-callused floret: lower palet about 2½ lines long, minutely 2-toothed at the apex, brownish at maturity, with long rather coarse hairs; upper palet nearly equal; awn 6 to 9 lines long, flexuosely geniculate near the middle, below which it is strongly pubescent (almost plumose), scabrous above: anthers conspicuously bearded. — Ill. i. 158; Trin. & Rupr. Stipaceæ, 59. *S. Bloomeri,* Boland. in Proc. Calif. Acad. iv. 168.

Mono Lake and near Sonora Pass, *Bolander,* n. 6116; "rare." Siberia, etc.

++ ++ Lower palet 3 to 5 lines long.

9. **S. Stillmani,** Boland. Culms tufted, stout, 3 to 5 feet high, geniculate below, smooth except the pubescent nodes: radical leaves 12 to 18 inches long, those of the culm (four or five) much shorter, all glaucous, involute at least at the long attenuate apex, the lower 3 to 4 lines wide at base, mostly smooth below, scabrous above and on the margins; ligule minute; sheaths loose, shorter than the internodes, striate, smooth, slightly bearded at the throat: panicle 5 to 10 inches long, narrow and spike-like, interrupted below, nearly white and lustrous, the axis puberulent with an incomplete pilose ring at the nodes; rays crowded and fasciculate, more or less united below, 1–few-flowered: glumes nearly equal, about 9 lines long, acuminately bristle-pointed, membranaceous-hyaline, the lower 3-, the upper more or less 5-nerved at base: floret 5 lines long with a short one-sided white-hairy callus; lower palet herbaceo-chartaceous, distinctly 3-nerved, sparsely pubescent throughout, the divisions of the 2-cleft tip nearly a line long; upper palet similar; awn inserted below the tip of the palet, 12 to 15 lines long, tortuous, slightly bent above the middle, scabrous: stamens 3; anthers long, mucronulate. — Proc. Calif. Acad. iv. 168.

Blue Cañon, Sierra Nevada, *Bolander.* The stout culms, as large as a goosequill, are from a large tortuous almost woody rhizome, which is hairy, as are the rootlets proceeding from it. The large and lustrous panicles are strikingly handsome.

10. **S. coronata.** Culm 4 to 6 feet high, 3 or 4 lines thick at base, where it is clothed with the remains of old sheaths: lower culm leaves about 3 feet long, 4 to 6 lines wide at base, gradually attenuate to a long involute point, the uppermost about 6 inches long, almost filiform and rigid, all slightly scabrous on both surfaces and

margins; ligule very short, lacerate-fringed; sheaths somewhat loose, the uppermost much dilated, striate, smooth except the margins, which are mostly ciliate, especially at the throat: panicle 12 to 16 inches long, at first spike-like and included for one-third or one-half its length, at length exserted and loose, but narrow with erect branches; lower rays in pairs or threes, long and flower-bearing above, the upper in fascicled clusters and flower-bearing to the base: spikelets short-pedicelled, pale-greenish becoming purplish: glumes unequal, the 3-nerved lower about 8 lines, and the 5-nerved upper 6 lines long, both acuminate and somewhat bristle-pointed, slightly scabrous on the nerves: floret, including the brief curved callus and long hairy crown, 5 lines long; lower palet scarcely chartaceous, bifid with delicate hyaline teeth less than a line long, clothed with silky shining hairs, those below about a line long, the upper more numerous, forming a dense tufted corona 2 lines long; awn about an inch long, slender, bent mostly below the middle and minutely scabrous; upper palet about half the length of the lower: stamens 3; anthers naked.

Hills near Julian City, San Diego County (*Bolander*); near San Bernardino, *Parry* & *Lemmon*, n. 422 (1876). The tallest and most robust of all North American Stipas; when young, with the panicle partly included, it appears somewhat like *S. Stillmani*, but it lacks the marked and peculiar lustre of that species. Later the panicle is exserted, becoming wider and loose and taking on a purplish tinge, and the resemblance is no longer noticed. The remarkably long hairs upon the floret have a peculiar silvery lustre; when highly magnified each hair is seen to be flat and spirally twisted.

11. **S. viridula**, Trin. Culms 1½ to sometimes 5 feet high, with numerous withered sheaths at base: leaves all involute-setaceous at apex, smooth or slightly scabrous, pale green, the radical about one-third as long as the culm; upper culm-leaf 1 to 1½ inches long; ligule very short; sheaths half the length of the internodes or less: panicle 6 to 18 inches long, narrow, loose, the short erect rays in twos or threes: spikelets 4 to 5 lines long, on shorter pedicels: glumes nearly equal, ovate, bristle-pointed, the lower 5-, the upper 3-nerved, sometimes tinged with purple: floret fusiform, about one-fourth shorter, the callus very short; lower palet with short scattered hairs which form a rather irregular crown and with 2 very minute hyaline teeth; upper palet more than half as long; awn 1 to 1½ inches long, slender, flexuose, usually twice bent, pubescent below and scabrous above, at length deciduous: anthers naked. — Act. Petrop. 1836, 39; Trin. & Rupr. Stipaceæ, 57; Watson, Bot. King Exped. 380. *S. parviflora*, Nutt. Gen. i. 58, not Desf. *S. spartea*, Hook. Fl. Bor.-Am. ii. 237, not Trin.

In the Coast Ranges and Sierra Nevada, northward to Oregon, the upper Missouri (*Geyer*) and British America. Very variable in the size of the culm and character of the panicle, which is usually slender and loosely flowered, sometimes reduced to a mere raceme of a few 1-flowered rays, and at the other extreme crowded and spike-like. The young states of this and *S. Sibirica* very closely resemble one another, but that has longer rays naked below, the floret more copiously silky and the anthers conspicuously bearded. The lower palet in *S. viridula* slightly projects on each side of the insertion of the awn, and when that at length falls the scar is oblique. The floret in both species becomes fuscous at maturity.

26. ARISTIDA, Linn. Triple-awned Grass.

Panicle racemose or spike-like, rarely spreading. Spikelets 1-flowered. Glumes unequal, the lower shorter, membranaceous, sometimes with a bristle-like point. Floret oval or cylindrical, with an obconic mostly hairy callus and readily falling at maturity. Lower palet chartaceous or coriaceous, longer than and inclosing the upper, entire at apex where it bears a three-parted awn, with or without a joint at its base. Scales 2. Stamens 3; anthers beardless. Ovary stipitate: styles distinct. Grain cylindrical, inclosed in the lower palet, but free from it.

Over 150 species are enumerated, of which the larger share belong to warm countries. The culms, from an annual or perennial root, are often much branched; the leaves narrow and mostly

involute. The triple awn separates the genus from *Stipa*, which it in other respects much resembles. In the Eastern States *Aristida* is represented by about a dozen species, while *Stipa* has but three; upon the Pacific Coast these numbers are very nearly reversed. In the division of the genus, those having the persistent straight awn continuous with and divided down to the palet are placed in the section *Chætaria*. Those with the awn divided above and twisted below to form a stipe, which is articulated with the palet and caducous, form the section *Arthratherum*, which is regarded by some as a genus.

1. **A. bromoides,** HBK. Culms from 3 to 12 inches high, forming close tufts, slender and often geniculate below: radical leaves few and short; those of the culm two, 1 or 2 inches long, involute-setaceous and rather rigid, smooth below, minutely scabrous above; ligule minute, fringed; sheaths shorter than the internodes: panicle 1 to 3 inches long, spike-like, somewhat secund, the rays solitary or clustered, branched nearly to the base: spikelets purplish, 4 to 5 lines long, on shorter pedicels: glumes narrow, mucronate, scabrous on the back, the lower about 2 lines long, the upper twice its length: floret mostly equalling the upper glume, its short callus with brief, very white hairs; lower palet greenish with numerous dark purple blotches, smooth except on the scabrous midnerve; middle awn rather longer than the palet, the lateral ones somewhat shorter, all minutely scabrous; upper palet very short, scarcely exceeding the ovary. — Nov. Gen. & Spec. i. 122. *A. dispersa*, var. *bromoides*, Trin. & Rupr. Stipaceæ, 130.

Colorado Desert (*Schott*); San Diego (*Bolander*); Sonora, New Mexico and Texas; Quito. A variable species, forms of which have been described under several names; these have been brought together by Trinius and Ruprecht as varieties of one species, to which they gave a new name *A. dispersa*. In this case it seems proper to continue one of the older names. The plant is probably an annual, though none of the specimens have roots. The same tuft has culms from 3 inches to a foot high; in the shorter ones the base of the panicle is included, but in the taller it is long exserted. In the young plant the panicles are dark purple; in older specimens, they become light brown.

2. **A. Californica,** Thurber. Culms 5 to 10 inches high, very densely tufted, geniculate below and branched above, pubescent, especially at the nodes: leaves involute, pubescent above, scabrous below, the radical from 1 to 1½ inches long, those of the culm shorter, the uppermost minute or reduced to a mere sheath; ligule a fringe of hairs; sheaths shorter than the internodes, loose, striate, pubescent or hirsute: panicle 1 or 2 inches long, racemose, few-flowered, the lower spikelets in pairs (one sessile, the other short-pedicelled), the upper solitary: glumes scabrous on the keel, lacerate-fringed at apex, usually purple with white margins, the lower 4, the upper 6 lines long: floret shorter than the lower glume, with a conspicuous white-hairy callus one-third its length; lower palet minutely scabrous, especially above, pale greenish and marked with purplish-black blotches, the upper palet about one-fourth as long; awns about equal, very slender, minutely scabrous, 1½ to 2 inches long, twisted below into a slender stipe (5 to 8 lines long), which is articulated with the upper palet and deciduous at maturity. — Bolander in Trans. Calif. Agric. Soc. 1864–65, 134, without description.

Colorado Desert (*Schott*); Fort Mohave, *Cooper*. Apparently an annual, which by its numerous branches and long awns forms a complex tuft. It is the only species of the section with articulated, caducous awns (*Arthratherum*) thus far found in North America. According to Mr. Schott it is known to the Mexicans as *Zacate de liebre*, "Hare's-grass."

27. SPARTINA, Schreb. Cord-Grass.

Panicle of mostly erect racemed spikes. Spikelets crowded in two rows upon one side of a triangular rhachis, subsessile, 1-flowered with no rudiment, much flattened laterally. Glumes rigid, more or less rough-bristly on the strongly compressed keel, acute or short-awned. Floret sessile, shorter than the upper glume. Lower palet membranaceous or chartaceous, awnless, the upper slightly longer. Scales none. Stamens 3. Ovary smooth: styles very long, more or less united below; stigmas

feathery. Grain laterally compressed, free. — Perennials, with creeping scaly root-stocks, and simple reed-like culms bearing long tough leaves with smooth sheaths.

There are about 8 species, though three times as many are described, found chiefly in warm climates. Four occur in the Atlantic States; though usually growing in salt marshes, some extend far inland.

1. **S. stricta**, Roth. Culms erect and stiff, 1 to 4 feet high: leaves coriaceous, smooth, a foot long or more, 6 to 8 lines wide at base, tapering to a long narrow convolute point; ligule a short fringe; sheaths rather loose, overlapping and quite clothing the culm: panicle 4 to 6 inches long, of 3 to 8 sessile erect spikes 1 to 3 inches long, the projecting point of the rhachis once or twice the length of the upper spikelet: spikelets 6 to 8 lines long, loosely imbricated, soft: glumes very unequal, smooth or merely scabrous on the keel, the larger 1-nerved: upper palet exceeding the lower. — Trin. Agrost. i. 90; Nees, Gen. i, t. 41. *S. foliosa*, Trin. l. c. 92, a very leafy form.

Salt marshes near San Francisco, *Bolander*. Common on both shores of the Atlantic, where it varies so much that several nominal species have been made of it. The stems and foliage, though coarse, are succulent and greedily eaten, but communicate a strong and rancid flavor to the milk, butter, and even to the flesh of animals that have fed upon it. It forms a more durable material than straw for thatching roofs, and it is known in some parts of New England as "thatch," and the unpleasant flavor given by it to milk and butter is called "thatchy."

2. **S. cynosuroides**, Willd. Culms 2 to 6 feet high, rather slender; leaves 2 to 4 feet long, 4 to 6 lines wide at base, tapering to a long slender involute point, smooth except on the margins; ligule bearded: spikes 5 to 20, scattered and spreading, at least at maturity, 2 to 4 inches long on pedicels about ½ inch long, the pedicels and common axis strongly hispid on the angles: spikelets closely imbricated: lower glume very narrow, the upper broad, spinulose-hispid on the keel and tapering to a rough awn about 3 lines long: floret equalling the lower glume; the lower palet very rough on the midrib which terminates just below its tip; upper palet about equalling the lower, rough at apex. — Torrey, Flora N. York, ii. 448, t. 153.

Oregon, *Howell*. Common on the Atlantic coast, growing along the lakes and the borders of rivers quite across the continent, and very likely to be found within the State.

S. GRACILIS, Trin., a slender species 1 to 3 feet high, with rough and rigid leaves and shorter and closely appressed spikes. Ranging from Oregon to Texas and found in alkaline soils in all parts of Nevada, *Watson*. It doubtless occurs in Northeastern California.

28. BOUTELOUA, Lagasca. GRAMA GRASS.

Spikelets in solitary or racemed spikes, sessile and crowded in two rows upon one side of a flattened rhachis, 2 – several-flowered; only the lowest floret perfect, the others more or less rudimentary and neutral, or rarely staminate. Glumes membranous, convex, keeled, the lower a half shorter. Lower palet of the perfect floret chartaceous, 3-toothed or 3-cleft at the apex and terminated by 3 subulate awns; upper palet 2-nerved, 2-toothed. Stamens 3, usually orange-colored or red. Scales 2, fleshy. Styles 2, terminal. Imperfect floret staminate and similar to the other, or more frequently incomplete and pedicellate, of a single palet with 3 teeth and 3 setæ, or reduced to 3 awns with or without scale-like palets. — Very slender grasses, often geniculate at base, with short leaves less than a line broad; ligule a hairy fringe.

A rather large American genus, most abundant in the warmer portions, but three species reaching the Northern States. *Eutriana*, Trin., *Chondrosium*, Desv., *Atheropogon*, Muhl., and *Diactra*, Beauv., are some of the genera under which they had been placed before Dr. Gray properly restored Lagasca's earlier name. The species are numerous in Western Texas and all the Rio Grande region, Northern Mexico, etc., where they are generally known as Grama-grass and form the larger share of the pasturage of the dry and elevated plains.

* *Spikes pectinately many-flowered, erect or spreading, the rhachis not prolonged beyond the spikelets.*

1. **B. oligostachya,** Torr. Perennial, 6 to 18 inches high: leaves smooth or barely roughened above: spikes 1 to 5, remote, 1 to 1½ inches long, often much curved, on very short hairy pedicels; rhachis smooth or sparingly hairy: spikelets (including setæ) about 3 lines long: glumes (the upper 2 lines long) strongly keeled, with a few minute hairy papillæ: lower palet equalling the upper glume, copiously hairy on the back, its long middle lobe 2-cleft; central seta longest (a line long); upper palet equalling the lower, with lateral tufts of long hairs at base: pedicel of sterile floret about a line long, hairy at top and bearing a rudimentary hooded palet and 3 very short awns. — Gray, Man. 621. *Atheropogon oligostachyum,* Nutt. Gen. i. 78. *Chondrosium oligostachyum,* Torr. in Marcy Rep. 300.

Summit of Providence Mountain, *Cooper.* This species, which extends from Wisconsin westward, is common in Nebraska and southwestward to Northern Mexico. The specimens from Dr. Cooper, who alone seems to have met with it in California, are only 6 inches high.

2. **B. polystachya,** Torr. Culms 3 to 15 inches long: leaves scabrous, often with a few hairy papillæ on the margins and midnerve; sheaths loose: spikes 3 to 6 or more, ½ to 1 inch long, rarely slightly curved, the scabrous rhachis hispid-ciliate: spikelets about 2 lines long: glumes often irregularly 2-toothed, the upper broadly ovate, a line long, rough-pubescent, short-awned below the apex: lower palet very hairy on the nerves below, otherwise smooth and shining, the central lobe rather obtusely bifid, the lateral narrow and acute; lateral setæ stoutest and longest; upper palet equalling the lower, silky-hairy on the margins and on each side at base: imperfect floret of 2 small (mostly) hooded palets and 3 setæ, upon a hairy pedicel which also bears a very minute rudimentary third floret. — Pacif. R. Rep. v. 366, t. 10. *Chondrosium polystachyum,* Benth. Bot. Sulph. 56; Torr. in Emory Rep. 153. *B. pumila,* Buckl. Proc. Acad. Phil. 1862, 93.

Fort Mohave (*Cooper*); Colorado River (*A. Schott*), and eastward; very common in the Rio Grande region and southward. Varying from nearly prostrate to erect with very slender culms; the spikes generally dark purple and the foliage more or less tinged. The setæ of the lower palet also vary considerably in length, and sometimes the imperfect floret has a broad cordate palet awned between the lobes, and the second imperfect floret becomes more conspicuous.

* * *Spikes short, few-flowered, at length reflexed: point of rhachis prolonged.*

3. **B. aristidoides.** Culms 6 to 18 inches high, branched above: leaves soon involute, scabrous above, margins with scattered 1-haired papillæ; sheaths very loose, smooth except a hairy tuft at throat on each side: spikes 4 to 8, distant, secund, 8 to 10 lines long, on white-hairy pedicels 2 lines long; rhachis scabrous, the triquetrous point equalling the terminal spikelet: spikelets 3, distant, appressed, about 3 lines long; lower glume almost setiform, the upper subulate, strongly keeled, sometimes 3-toothed: perfect floret with a slightly bearded callus; lower palet coriaceous, silky-pubescent on the nerves, minutely punctulate, nearly equalled by the upper: imperfect flower on a short pedicel slightly hairy at top, of 3 unequal awns, one 3 lines long, the shorter slightly dilated below. — *Dinebra aristidoides,* HBK. Nov. Gen. i. 171, t. 695. *Eutriana aristidoides,* Kunth, Enum. i. 280, and Suppl. 233.

Fort Yuma (*Major Thomas*); San Diego County, *Palmer.* Common in Arizona and Mexico. Apparently monocarpic, the cluster of withered sheaths at the base indicating that it takes a rest and completes its growth the second season. The young plant, with its spikes erect and appressed, presents a strikingly different appearance from the old one, when its fully developed spikes are refracted. The long awns to the sterile floret give it so strong a resemblance to an *Aristida* that the specific name is especially descriptive.

29. CYNODON, Richard. Dog's-tooth Grass.

Inflorescence in several one-sided flattened spikes which are digitate at the end of the peduncle. Spikelets 1-flowered, with a rudiment consisting of a naked pedicel

or a pedicelled imperfect floret, awnless, sessile in 2 rows. Glumes keeled, pointless, somewhat unequal, spreading, shorter than the floret. Palets pointless, awnless, the lower larger, boat-shaped, prominently keeled, the upper 2-nerved, concealing the rudiment in its fold. Stamens 3. Styles 2, rather long with feathery stigmas.

A genus of which about a dozen species are described, but most of them are supposed to be forms of the widely disseminated perennial one here given.

1. **C. Dactylon,** Pers. Culms prostrate, stout, often creeping several feet, clothed with undeveloped sheaths, and throwing out prostrate branches, as well as ascending geniculate flowering ones 6 to 10 inches high: leaves about an inch long and a line wide, with a rather obtuse scabrous apex, stiff and sometimes involute, glaucous; ligule short with very long hairs; sheaths much crowded, loose, strongly striate: spikes 3 to 6, an inch or two long, the rhachis concavo-convex: spikelets rarely over a line long, imbricately appressed: glumes ovate, usually spreading and rough on the keel; lower palet broadly boat-shaped, smooth, the keel and margins ciliate; upper palet narrow; rudiment half as long as the floret, sometimes minute. — Reichenb. Icon. Flor. Germ. t. 26; Nees, Gen. 1, t. 39.

Near San Bernardino (*Parry & Lemmon*); San Jose, *M. Jackson Lewis.* This is the "Doub" of the East Indies, the "Dog's-tooth Grass" of Europe, but in this country always called "Bermuda Grass." It is very common in all warm countries, including Australia; in the Eastern States it is thoroughly naturalized, being found as far north as Pennsylvania, and far more abundantly south and southwestward, varying greatly in size according to the character of the soil; the spikes are sometimes purplish. This and the Crab-grass, *Panicum sanguinale*, are popularly often confused; that has its spikelets inserted on the rhachis by pairs, one sessile, the other pedicelled, while in this they are all sessile and solitary. Though a troublesome weed in the cotton fields, it is by many regarded as the most valuable of pasture grasses for the Southern States, and of great value even for hay. It is a singular fact that it has never been known in the Eastern States to perfect its seed, and it can only be propagated by cuttings.

30. LEPTOCHLOA, Beauv. Slender Grass.

Panicle simple, its branches being long slender spikes, upon one side of which the spikelets are sessile in two rows. Spikelets 3–several-flowered, the uppermost imperfect. Glumes membranaceous, the upper larger, keeled and often subulate-pointed. Lower palet 3-nerved, ciliate or hairy, entire or 2-toothed, awnless or bristle-awned from between the teeth. Upper palet smaller, prominently 2-nerved. Stamens 2 or 3. Ovary stipitate: styles simply plumose. Seed, in some species, loose in the pericarp.

A small genus, as to the limits of which botanists differ; species with the lower palet bristle-awned between the teeth are by some referred to *Diplachne*, Beauv.

1. **L. fascicularis,** Gray. Annual, culms ½ to 2 feet high, decumbent, geniculate, branching: leaves flat, 4 to 6 inches long, smooth or roughish, the upper mostly equalling the panicle; ligule a line long, lacerate; sheaths loose: panicle 4 to 8 inches long, its base usually included; spikes strict, 3 to 4 inches long; spikelets solitary or in twos or threes, short-pedicelled, 3 to 5 lines long, 5–11-flowered, the joints minutely hairy-tufted: glumes lanceolate, acute, rough on the strong single nerve, often mucronate, the lower at least a half shorter than the lower floret, the upper as much longer; lower palet ovate-lanceolate, ciliate below the middle, short-awned at the cleft apex, with two minute lateral teeth; upper slightly shorter, short-pointed, silky-ciliate: styles very long: pericarp membranous. — Man. 623, t. 9; Durand & Hilg. in Pacif. R. Rep. v. 15. *Festuca polystachya*, Michx.; Ell. Sketch, i. 169, t. 10, fig. 3. *Diplachne fascicularis*, Beauv. Agrost. 80, t. 16, fig. 9. *Uralepis* (*Tricuspis*) *composita*, Buckl. in Proc. Acad. Philad. (1863), 94.

Pose Creek (*Heermann*); Fort Yuma (*Major Thomas*); Colorado River, *Newberry.* This does not appear in any of the collections made by the State Survey, yet must be more frequent than this

would indicate, as it extends from New England quite across the continent. It is found along nearly the whole Atlantic coast, usually in brackish marshes, rarely over a foot high. The far-western plant is more luxuriant, and the clustered spikelets give the panicle a denser appearance.

2. **L. imbricata,** Thurber. Culms simple, erect, 1 or 2 feet high : leaves 6 to 8 inches long, 2 lines wide at base, setaceously acuminate, slightly scabrous ; sheaths loose : panicle erect, 8 to 10 inches long, usually sheathed at base ; spikes very numerous, solitary or fascicled, slightly spreading : spikelets appressed-imbricate, nearly sessile, acute, 7 – 8-flowered, about 3 lines long : glumes very unequal, hispid on the prominent solitary nerve, the lower narrow, acute, about half as long as the lowest floret, the upper broader, obtuse, mucronate, more than a half longer : lower palet about a line long, herbaceo-membranaceous, minutely 2-toothed at the obtuse mucronate apex, the lateral nerves long-pilose below ; upper palet equalling the lower, obtuse and denticulate at apex and hairy on the nerves : seed loose in the pericarp. — Gram. Mex. Bound. ined.

Larken's Station, San Diego County (*Palmer*, n. 404) ; Fort Yuma (*Major Thomas*) ; and through the Gila Valley to the Rio Grande. The lower leaves and sheaths are sometimes tinged with purple, the panicle usually grayish green. Habit somewhat that of *L. fascicularis*, but the spikes are much narrower, the spikelets being smaller, closely appressed and overlapping. In the shape of the lower palet they are very distinct ; in place of the acute teeth and manifest awn of the other, the teeth in this are minute and blunt and the midnerve produced only as a mere point.

31. PLEURAPHIS, Torr.

Panicle dense and spike-like. Spikelets in threes at the alternate notches of a slender flexuose excavated rhachis, subtended by a tuft of hairs. Lateral spikelets 2 – 3-flowered, staminate ; central spikelet 1 – 2-flowered, perfect, flattened, broad, membranous, with nearly equal cuneate glumes often 2-cleft at the apex and with several (5 to 9) nerves, one or more excurrent below the tip as setæ. Lower palet 3 – 5-nerved, cleft and short-awned above ; upper 2-nerved and 2-toothed. Stamens 3, with short filaments. Scales 2, ligulate, entire. Styles 2, very long, stigmatose with simple hairs for the greater part of their length. Lateral spikelets narrow, similar to the other in texture. Glumes 2-cleft or entire, 3 – 5-nerved, awned at or below the apex. Palets nearly equal, toothed, the lower 3-nerved, the upper 2-nerved. — Ann. Lyc. N. York, i. 148, t. 10 ; Watson, Bot. King. Exped. 381.

A small genus of perennials, in several works placed with *Chlorideæ*, but its relationships are rather with the *Pappophoreæ*. For a long time but a single species was known, but the discovery of another, and perhaps two more, has rendered it necessary to so modify the character as to give less importance to the setæ upon the glumes, which in one probable species are nearly muticous. The original species, P. Jamesii, Torr., l. c., common in Nevada and the Rocky Mountain region, and perhaps reaching Northeastern California, has slender culms which branch only near the base. In Arizona and westward it is replaced by the species here described, and by *P. mutica*, Buckl.

1. **P. rigida,** Thurber. Culms 2 feet high or more, erect, branching above, solid throughout, clothed, especially within the sheaths, with a dense matted tomentum : lower leaves 4 or 5 inches long, uppermost about an inch, rigid, mostly involute, setaceous-pointed ; ligule very short, lacerate ; sheaths somewhat crowded, upper very loose : panicle 3 or 4 inches long, mostly included at base, pale, tinged with purple : glumes of central spikelet cuneate at base, bifid above, woolly-fringed, 3- or indistinctly 5-nerved, the central nerve excurrent just below the middle as a stout rough divergent awn a little exceeding the glume, the next two produced as setæ between the lobes and about equalling them : florets stipitate ; lower palet broad, 3-nerved, irregularly 2-toothed and fringed above, the awn slightly exceeding the teeth ; upper palet somewhat the longer : glumes of lateral spikelets about equalling the florets, irregularly toothed above, one or more nerves terminating as short straight or recurved awns : palets of staminate florets nearly equal, the lower 3-nerved and

2-toothed and more or less distinctly awned. — Gram. Mex. Bound. ined.; Boland. in Trans. Calif. Agric. Soc. 1864–65, 137, without description.

Fort Mohave and Providence Mountains (*Cooper*); Fort Yuma (*Major Thomas*); Colorado Desert, (*A. Schott*), and along the Gila River. A striking species on account of its rigid woody stems, in habit resembling some of the dwarf Bamboos. Regarded as valuable forage, at least for mules, which eat its almost woody stems with avidity. The pubescence of the culms within the sheaths is singularly matted and dense and very white.

32. DANTHONIA, DC. Wild Oat-Grass.

Panicle loose or often a simple raceme. Spikelets several- (about 7-) flowered. Glumes about equal, keeled, unawned, as long as or longer than the flowers. Rhachis of spikelets hairy. Lower palet rounded on the back, 7–9-nerved, terminating in two sharp usually rigidly awl-pointed teeth, between which is an awn flattened below and spirally twisted, formed from the three middle nerves. Upper palet broadly 2-nerved, equalling or exceeding the entire portion of the lower. Stamens 3. Scales 2, somewhat fleshy, entire. Ovary smooth, stipitate. Grain not adherent to the palets.

A genus of over 100 species, especially abundant in Africa; a few belong in the Atlantic States and one is peculiar to the western coast. Mostly perennials.

1. **D. Californica**, Boland. Culms sometimes decumbent at base, from ½ to 3 feet high: leaves, especially the lower, convolute and setaceously pointed; ligule obscure; sheaths rather loose, bearded at the throat: panicle mostly a simple raceme, the usually 3 to 5 (rarely 10) solitary rough-hairy pedicels scarcely as long as the broad spikelets: glumes mostly purplish with scarious margins, pointed, 8 to 10 lines long, the upper 5–7-nerved: lower palet broad, shining on the back, coriaceous below, its teeth about half its own length, obscurely 9-nerved, with marginal tufts of long silky hairs at or below the middle; awn about equalling the palet, brownish below; upper palet ciliate, notched above. — Proc. Calif. Acad. ii. 182; Watson, Bot. King Exped. 392.

Var. **unispicata**. Culms 6 inches high or less, from dense tufts of somewhat hairy leaves, the sheaths of which are densely villous with white spreading hairs about 2 lines long, arising in small clusters from minute white papillæ: spikelet solitary and terminal (rarely 2 or 3), usually fewer-flowered than in the type. — *D. unispicata*, Munro in Herb. *D. spicata* (?), Thurb. in Bot. Wilkes Exped. 488.

Both forms occur from San Diego to San Francisco (*Bolander*, *Parry*, *Lemmon*); also in Oregon and in the Rocky Mountains. The same large tuft often produces both tall and short culms of the typical form. Some Rocky Mountain specimens, with the several-flowered panicle of the type, have hairy sheaths, but less so than in the variety.

2. **D. sericea**, Nutt. Culms not tufted, 1 to 3 feet high: leaves narrow, with sheaths silky-hairy at the throat: panicle narrow, the lower rays sometimes 2–3-flowered and spreading; spikelets 6 to 8 lines long, the acuminate glumes much exceeding the florets: lower palet with very long teeth, and villous with long silky hairs all over or only below and on the margins. — Gen. i. 71; Gray, Man. 640.

Yosemite Trail, at 8,000 feet altitude, *Bolander*, n. 6104. This agrees with the eastern plant, excepting that the lower palet is less copiously hairy. Specimens that have been referred to *D. spicata*, Beauv., belong to *D. Californica*. Should that species be met with it will be known by its very short leaves, its small narrow spikelets, only 3 to 5 lines long, and its coarsely hairy lower palet with short and pointless teeth.

33. AVENA, Linn. Oat.

Panicle loose and few-flowered. Spikelets large, of few (3 to 5) florets, of which the uppermost is imperfect. Glumes nearly equal, often exceeding the florets, many-

nerved. Florets herbaceo-chartaceous, becoming firmer than the glumes, upon a hairy-bearded rhachis. Lower palet rounded on the back, 5–11-nerved, acutely 2-cleft at tip, bearing from between the teeth a long bent or twisted awn which proceeds from the midnerve only. Upper palet equalling the lower, minutely bifid. Stamens 3. Scales 2, bifid at apex. Ovary hairy above: styles short, distant; stigmas densely plumose. Grain cylindrical-oblong, deep-grooved, hairy throughout or at the tip only, closely invested by the upper palet.

A genus of about 30 annual and perennial species, belonging to temperate and cold regions. Two species are found in the Eastern States. *Trisetum* and *Arrhenatherum* are by some botanists included as sections of this genus.

1. **A. fatua,** Linn. An erect annual, 2 or 3 feet high, smooth except at the hairy nodes, with flat slightly scabrous leaves and loose sheaths: panicle 8 to 10 inches long, the few-flowered rays spreading equally; spikelets about an inch long, the scarious pointed glumes longer than the florets, often purplish at base: lower palet about 6 lines long, firm at base, scabrous and covered with long brown hairs, its lobes tapering to a sharp point; awn about twice the length of palet, bent near the middle and twisted below: grain very hairy. — Kunth, Enum. i. 302, and Suppl. 256; Benth. Illust. Brit. Flor. t. 1179; Watson, Bot. King. Exped. 392.

Common in fields. Probably a native of the Mediterranean region, but naturalized in many grain-growing countries, including South America and Australia. As the "Wild Oat" it is highly valued for hay. It is supposed to be the original of the cultivated oat (*A. sativa*), which is said to readily degenerate into this. Professor Buckman of England gives a detailed account of having produced from the seeds of this a good variety of smooth cultivated oat in a few years' successive sowing and selection.

34. TRISETUM, Beauv.

Panicle mostly narrow, loose or dense and even spike-like. Spikelets 2- (rarely 3- or more-) flowered. Glumes unequal, acute, keeled, membranaceous with scarious margins, the lower 1-nerved, upper (sometimes both) 3-nerved. Florets more or less separated by the hairy joints of the rhachis, the last one of which extends beyond the upper spikelet as a rudiment, sometimes bearing an imperfect floret. Palets similar in texture to the glumes, the lower keeled, 5-nerved, acute, more or less deeply bifid, bearing above the middle an awn which proceeds from the midnerve, usually twisted at the base and bent near the middle. Upper palet 2-nerved and 2-toothed. Ovary hairy or smooth: styles stigmatic from near the base. Grain smooth, not furrowed.

Over 60 species have been described, having a geographical range similar to *Avena*, to which some authors unite it. Two species belong to the Atlantic States.

* *Panicle open with elongated rays: ovary hairy at the apex.*

1. **T. cernuum,** Trin. Culm 2 or 3 feet high, with flat leaves about 6 inches long and nearly half an inch wide: panicle 6 to 10 inches long, very open, nodding above; rays in distant clusters, cernuous, capillary, roughened, flower-bearing above the middle; spikelets 2–3- (rarely 4-) flowered: lower floret with a short-bearded callus, the others spreading, distant, upon hairy joints half as long as the florets: glumes very unequal, the lower narrow, subulate, less than one-half the length of the broad 3-nerved obtuse and mucronate upper one: lower palet about 3 lines long, slightly scabrous especially above, bearing a slender awn twice its own length, and terminating in two subulate teeth, which bear setæ nearly a line long; uppermost joint of the rhachis with a long weak awn. — Mem. Acad. St. Petersb. 1831, 61; Hook. Fl. Bor.-Am. ii. 244. *Avena cernua,* Kunth, Enum. i. 306; Griseb. in Ledeb. Fl. Ross. iv. 419.

Mendocino County (*Bolander*, n. 6122); Oregon (*Pickering*); also Sitka. The conspicuous inequality of the glumes, and the long capillary branches of the panicle, which are naked below, distinguish it from the next, which has been confounded with it.

2. **T. canescens**, Buckl. Culms 2 to 4 feet high, the flat leaves and sheaths smooth or pubescent: panicle 6 to 12 inches long, narrow, somewhat crowded with suberect branches, flower-bearing below the middle or to the base; spikelets 2–3-flowered, narrow: lower glume narrow, acute, about one-fourth shorter than the broad ovate-lanceolate upper one: lower palet about 4 lines long, narrow, tuberculate-roughened, long subulate pointed, the awn stout and about twice its length. — Proc. Acad. Philad. 1862, 100; Gray in same, 337. *T. elatum*, Nutt. in Herb. Acad. Philad.; Boland. Cat. 34.

San Francisco and elsewhere, *Bolander*, n. 4744, 4758, 6077, 6122. Varies in the width of the leaves and density of the panicle, which is often purple-tinged. Some specimens have the leaves more or less hairy and the sheaths retrorsely pilose, which is the typical form collected by Nuttall and described by Buckley. In some of Mr. Bolander's earlier distributions this was sent out as *T. cernuum*, Trin.

3. **T. barbatum**, Stend. Culm geniculate below and sometimes branched, 1 or 2 feet high, the lanceolate leaves 3 or 4 inches long, flat and with the sheaths pilose: panicle 3 to 6 inches long, the lower rays slender, suberect, few-flowered, the upper short, 1-flowered; spikelets large, 6 to 9 lines long, 3–5-flowered, much flattened: glumes narrow, hairy on the keel, acute, the upper somewhat longer, 3-nerved and nearly equalling the floret; joints of rhachis short, nearly smooth: lower palet 6 lines long, hirsute all over, the subulate teeth 3 or 4 lines long, the stout awn about as long as the palet and twisted below; upper palet about equalling the lower, hairy on the nerves: ovary elongated, not so copiously hairy as in the other two species, but distinctly so. — Syn. Gram. 229.

San Francisco, Oakland, and elsewhere (*Bolander*, n. 1551, 6128); collected also on the Ives Colorado Expedition. With the exception of being hairy the specimens agree well with Steudel's description, drawn from Chilian specimens. It is much the largest-flowered species, with the appearance of a *Bromus*.

* * *Panicle dense and spike-like: ovary smooth.*

4. **T. subspicatum**, Beauv. Culms tufted, perennial, 4 inches to 2 feet high, smooth or downy: leaves flat and smooth or with the loose sheaths pubescent; ligule long: panicle 2 to 6 inches long, dense and oblong-ovate, or elongated and several times interrupted below, shining and more or less purplish; spikelets flat, 2–3-flowered: lower glume shorter, the upper about equalling the florets, both ciliate on the keel; lower palet 3 lines long, smooth or minutely scabrous, the divergent awn about its own length. — Kunth, Enum. i. 295, and Suppl. 248; Stend. Syn. Gram. 225. *T. airoides*, Roem. & Schult.; Trin. in Mem. Acad. St. Petersb. 1831, 64.

Var. **molle**, Gray. Culm and foliage minutely soft-downy. — Man. 641, t. 12. *T. molle*, Trin. l. c.; Torr. Fl. N. York, ii. 452, t. 154. *Avena mollis*, Michx.

Var. **muticum**, Bolander, in herb. Panicle elongated and interrupted below; the florets awnless or very short-awned.

On the Upper Tuolumne (*Bolander*, n. 5019, var. *muticum*), and in the high Sierras at 9,000 to 11,000 feet altitude, *Brewer*, n. 1947, 2002 (var. *molle*), 2044. From New England westward along the Lakes, in the higher mountains from Colorado to California, and northward to the Arctic Ocean. The specimens from the higher localities are only about 4 inches high with very dense ovate spikes. In var. *muticum* the lower palet is sometimes entire as well as awnless, but neither character is constant.

35. AIRA, Linn. Hair-Grass.

Panicle loose (rarely contracted), open, with slender mostly capillary branches. Spikelets small, with two perfect flowers, the upper somewhat distant upon the rhachis, often with a pedicel or rudiment of a third flower. Glumes thin, membranaceous, 1-nerved, acute, equalling or exceeding the florets. Lower palet thin

and scarious, 2-cleft, or truncate and denticulate above, with a slender bent or straight awn on the back below the middle. Stamens 3. Ovary smooth: styles plumose to the base. Grain oblong, free or adherent to the palets.

Annuals and perennials, natives of temperate regions, the number of species estimated at about 30, though three times that number are described. The species here given belong to the section *Deschampsia*, Beauv., to which some botanists accord the rank of a genus. They are perennials, with the rhachis of the spikelet produced as a pedicel or rudiment beyond the attachment of the upper floret; the lower palet is delicately 3–5-nerved, and eroded or toothed at the truncate summit, with the awn attached near the base; grain not adherent to the palets.

* *Glumes barely equalling and mostly shorter than the florets.*

1. **A. cæspitosa,** Linn. Culms 2 to 4 feet high: leaves rather stiff, flat or convolute: panicle 4 to 12 inches long, nodding above, the spreading capillary branches flower-bearing above the middle; spikelets much compressed, shining, brownish, lead-colored or purplish, about 2 lines long: lower palet very thin, silky-hairy at base, irregularly toothed; awn inserted near the base, very slender, equalling or slightly shorter or longer than the palet. — Reichenb. Icon. Fl. Germ. t. 96; Trin. Icon. t. 253, 254. *Deschampsia cæspitosa*, Beauv.; Griseb. in Ledeb. Fl. Ross. iv. 421. *Aira Bottnica*, Wahl.; Trin. Icon. t. 255. *A. arctica*, Trin. Mem. Acad. St. Petersb. 1831, 56. *Deschampsia brevifolia*, R. Br. in Parr. Voy. 191.

San Francisco, and especially in the Sierra Nevada, from Kern River (*Rothrock*) to Oregon and northward, *Lyall*. It extends from New England westward across the continent and to Sitka. Very variable, especially in mountainous and high northern localities, its different forms having been described as species. The dwarf mountain plant, 6 or 8 inches high, with a tuft of short setaceous leaves, is var. *arctica*, Trin., and *Deschampsia brevifolia*, R. Br. The awn is sometimes considerably longer than the palet, when it is *A. Bottnica*, Wahl., and hardly a variety. Mr. Bolander collected in Calaveras County specimens with longer spikelets than usual, some of which are 3-flowered, in these respects agreeing with specimens labelled var. *longiflora* by Trinius in Herb. Torr.

2. **A. holciformis,** Steud. Culms very stout, 2 to 5 feet high, from a dense tuft of narrow stiff involute leaves 15 to 20 inches long; culm leaves distant and narrow, the uppermost about 2 inches long: panicle erect, narrow, with suberect rays, which are branched and flower-bearing to the base; spikelets about 3 lines long, short-pedicelled, nearly terete: glumes acute, rough on the nerves and near the apex: lower palet ovate-lanceolate, membranaceous, rather regularly 4-toothed, smooth and shining below, slightly scabrous near the tip, a silky tuft at base; awn stout, inserted near the base and barely exceeding the palet. — Syn. Gram. 221; Boland. in Trans. Calif. Agric. Soc. 1864–65, 138. *Deschampsia holciformis*, Presl, Rel. Hænk. i. 251.

San Francisco and Oakland, *Bolander*, n. 1524, and n. 6071, which is in the collection labelled *A. cæspitosa*, var. *densiflora*, and was probably so distributed. A very robust species with culms as large as a goose-quill. Both glumes and palets are yellowish-brown above and more or less tinged with purple below. Its erect and more dense panicle and the firmer texture of its narrower spikelets distinguish this from any form of the preceding. Mr. Bolander says, l. c., "It yields a large bulk of hay in moist meadows, but of what quality I am unable to say."

* * *Glumes longer than the florets.*

3. **A. elongata,** Hook. Culms very slender and weak, 1 to 3 feet high or more: leaves long, very narrow, mostly flat and smooth; ligule elongated: panicle very long and narrow, occupying about one-third of the culm; rays very unequal, distant, mostly appressed, capillary and flower-bearing above the middle, scabrous: glumes about 2 lines long, linear-subulate, nearly equal, 3-nerved, green and scabrous on the keel: lower floret on a short callus, the upper upon a very plumose joint two-thirds as long as the lower; lower palet about a line long, smooth and shining, with a silky tuft at base, irregularly 5-toothed above, with a very slender awn from near the base twice its own length or more; lower palet of the upper floret sometimes scabrous near the tip: terminal joint of the rhachis strongly plumose, about $\frac{2}{3}$ as long

as the upper floret. — Fl. Bor.-Am. ii. 243, t. 228; Torr. in Pacif. R. Rep. iv. 155. *Deschampsia elongata*, Munro in Benth. Pl. Hartweg. 342.

San Francisco (*Bolander*, n. 1525, 6086); northward to Oregon, *Hall, Howell.* Very variable in height; sometimes purplish, but usually of a very bright but pale green. As noted by Torrey, l. c., Hooker's otherwise excellent figure lacks the conspicuous rudiment.

4. **A. danthonioides**, Trin. Culm slender, from a few inches to 2 feet high, sometimes geniculate and sparingly branched below: leaves very narrow, those of the culm 1 or 2 inches long, with elongated ligules: panicle very loose and open, about ⅓ the length of the culm, the lowermost rays in threes, the others in pairs or solitary, distant, mostly spreading and few- (about 5-) flowered above the middle: glumes 3 lines long or more, linear-lanceolate, acuminate, 3-nerved, green and rough on the keel: lower floret on a brief callus, the upper raised to the middle of the lower; lower palet a little over a line long, the hairs at base ⅓ as long, shining below, its truncate apex with 4 minutely ciliate teeth; awn inserted just below the middle, about 3 times its length, light brown, twisted below and geniculate near the middle. — Mem. Acad. St. Petersb. 1831, 57, and Icon. t. 255. *Deschampsia calycina*, Presl, Rel. Hænk. i. 251. *D. danthonioides*, Munro in Benth. Pl. Hartweg. 342. *Trisetum glabrum*, Buckl. in Proc. Acad. Philad. 1862, 100; Gray, in same, 337.

Monte Diablo (*Brewer*, n. 1183); Oakland, etc. (*Bolander*, n. 6072); Sierra Nevada (*Lemmon*); northward to Oregon (*Nuttall, Hall*) and eastward to Texas. According to Mr. Bolander it is very abundant in some moist localities, forming the bulk of the herbage.

5. **A. latifolia**, Hook. Culm from 1 to 2 feet high, its lower leaves 2 or 3 inches long and about 3 lines wide, flat and smooth; panicle at first included below, with few slender rays which are densely flowered above; spikelets very broad and flattened: glumes about 3 lines long, ovate-lanceolate, acuminate, rough on the keel above: lower palet about a line long, its silky hairs half as long or more, very broad, irregularly 4-toothed and minutely pubescent above; awn stout, attached just above the middle, somewhat divergent, exceeding the palet but included by the glumes: the second floret upon a very short joint which reaches only about one-fourth the length of the lower floret; upper joint or rudiment very brief, but manifest. — Fl. Bor.-Am. ii. 243, t. 227.

Oregon (*Hall*); Washington Territory (*Cooper*); Rocky Mountains. This has not been detected within the State, but is likely to occur in the northern portion. In his description Hooker gives the awn as inserted below the middle, but figures it correctly.

36. ARRHENATHERUM, Beauv. Oat-Grass.

Panicle open. Spikelets subterete, 2-flowered, with the rudiment of a third. Lowest flower staminate, with a long bent awn below the middle of the back. Second flower perfect, its lower palet bristle-pointed from near the tip. Otherwise as *Avena*.

A genus of a single species, which is sometimes included in *Avena*, from which it is separated by having its lowest flower staminate.

1. **A. avenaceum**, Beauv. Culm perennial, 2 to 4 feet high, with broad flat soft leaves; panicle 6 to 8 inches long, narrow, spreading in flower: spikelets 4 or 5 lines long, pale and shining: lower glume about half as long as the upper, which equals the florets: lower palet of staminate flower about 5-nerved, its awn twice its length; that of the upper floret 7-nerved, both hairy near the base. — Agrost. 55, t. 11, fig. 5; Reichenb. Icon. Fl. Germ. t. 104.

A native of Europe and naturalized as a weed; occasionally sown as a meadow grass in the older States.

37. HOLCUS, Linn. Velvet Grass.

Spikelets crowded on the branches of an open panicle and jointed upon their pedicels, compressed, 2-flowered. Glumes boat-shaped, membranaceous, exceeding the

flowers, the lower 1-nerved, the broader upper one 3-nerved. Florets pedicelled, the lower one perfect, the upper staminate with a short bent awn just below the apex. Palets subcoriaceous, the lower 5-nerved. Scales 2, oblique and pointed. Stamens 3. Ovary smooth; stigmas sessile, feathery. Grain flattened, smooth, free.

An Old-World genus of about half a dozen species, one of which is widely naturalized.

1. **H. lanatus**, Linn. (Meadow Soft-Grass.) Culms from a perennial creeping rootstock, 1 to 2 feet high, the whole plant with a soft velvety pubescence which gives it a whitish color: leaves flat, soft, the upper sheaths inflated: panicle 2 to 5 inches long, pale and sometimes reddish, the branches in twos or threes; spikelets 2 lines long: upper glume with a slight point or awn near the tip: lower palet of perfect floret smooth and shining, that of the upper one thinner, its awn enclosed by the glumes. — Reichenb. Icon. Fl. Germ. i. 18, t. 97.

Introduced and naturalized around settlements in various parts of the State, and quite conspicuous from its pale color. Common in the Eastern States in meadows, along roadsides, etc. Of very little value, though sometimes cultivated in Europe where better grasses will not grow. Its companion species, *H. mollis*, Linn., by some regarded as a variety, is barely naturalized in New York State; it is more slender, less downy, but conspicuously so at the joints; the glumes are more acute and the awn of the upper floret projects beyond them.

38. LAMARCKIA, Moench.

Panicle short, spike-like, secund, with both fertile and sterile spikelets intermixed in small clusters. Fertile spikelets 2-flowered, the lower perfect, stipitate, the other long-pedicelled, rudimentary, awned. Glumes lanceolate-subulate, about equalling the spikelet. Perfect floret with a 5-nerved lower palet bearing a slender awn near the apex. Stamens 3. Styles short; stigmatic hairs remote. Sterile spikelets with acute glumes and numerous broadly obtuse or truncate loosely imbricated palets.

A genus of a single species, a native of the Mediterranean region and found in Australia.

1. **L. aurea**, Moench. A tufted annual, 3 to 6 inches high, its lower leaves crowded, the usually short upper one with a very conspicuous acute often bifid ligule 4 lines long: panicle very dense, often half of the height of the culm, yellowish or light brownish: fertile floret about 2 lines long, with an awn equalling or exceeding it in length: sterile spikelets 4 or 5 lines long, of 10 or more scarious palets, the upper edge of which is sometimes erose. — Kunth, Enum. i. 389, and Suppl. 324; Nees, Gen. t. 77. *Chrysurus aureus*, Beauv.; Reichenb. Icon. Fl. Germ. t. 149.

Colorado Desert, *Parry & Lemmon*. This elegant little grass was not known on this continent before its discovery as above in 1876. It has twice been found in Australia, but Bentham refers its occurrence there to accident or to cultivation. Dr. Parry writes that it was found where one would hardly expect an introduced grass, yet he thinks it may have been accidentally brought in.

39. PHRAGMITES, Trin. Reed.

Panicle large, much branched and terminal. Spikelets 3 – 7-flowered, the lowest staminate only, 1 – 3-androus, the others perfect. Florets somewhat distant, separated by joints of the rhachis which bear long silky hairs enveloping the florets, except the lower, which is naked. Glumes membranous, shorter than the florets, keeled, sharp-pointed and very unequal. Lower palet membranous, long-acuminate, entire and 3-nerved, thrice as long as the upper. Stamens 3. Scales 2, very large, obtuse. Ovary smooth: styles short, plumose above with simple hairs. Grain oblong, loosely invested by the palets.

A genus of about 5 species, separated from *Arundo* on account of its staminate lower floret; by some it is placed near *Calamagrostis*.

1. **P. communis,** Trin. A tall perennial, with extensively creeping jointed rootstocks, and stout culms 5 to 12 feet high, clothed to the panicle with ample leaves, which are glaucous beneath, rough on the margins and 1 or 2 inches wide: panicle 10 to 18 inches long, loose and nodding, usually purple; spikelets 6 to 9 lines long, the upper joint of the rhachis bearing a rudimentary palet or a mere point: the very narrow tip of the lower palet sometimes twisted: the silky hairs of the rhachis lengthen as the seed ripens, becoming very conspicuous. — Fund. Agrost. 134; Reichenb. Icon. Fl. Germ. t. 185; Nees, Gen. t. 37. *Arundo Phragmites,* Linn.

San Francisco and elsewhere common; extends throughout North America. The common Reed is found in nearly every part of the world; growing in wet places, especially along the margins of rivers, its creeping rootstocks are of service in preventing the washing away of the banks. Its young shoots are eaten by cattle, and its mature stems are useful for many purposes, especially as thatching material, it being said to outlast all others. From its stately habit, it is often planted for ornament, as are the closely related *Arundo Donax* and *Gynerium argenteum,* the "Pampas-Grass."

40. EREMOCHLOE, Watson. Desert-Grass.

Panicle short and contracted, simple or nearly so. Spikelets 4-flowered, the lower two florets neutral, the uppermost reduced to a stipitate villous triple awn. Glumes membranous, keeled, 1-nerved, acute, glabrous, rather exceeding the flowers, the lower a little the shorter. Palets membranous, the lower 2-cleft to the middle, 3-nerved, the strongly villous nerves produced as awns, the middle one longest and between the lobes, which in the neutral florets are obtuse and in the perfect floret attenuate. Upper palet shorter, bicarinate, 2-nerved, 2-lobed or 2-toothed at the apex, imperfectly developed in the neutral florets. Stamens 2. Styles 2, the elongated stigmas very minutely hairy. Grain free, sessile, obovate, smooth. — Bot. King Exped. 382, t. 40.

Low biennial desert grasses with fibrous roots, the sheaths bearded at the throat and often ciliate, the leaves short, rigid, revolute-setaceous, striate and pungent. Only two species are thus far known, one of which, first discovered in Nevada, seems likely to occur within the State. The second species (*E. Bigelovii,* Watson) is confined to the Rio Grande region.

1. **E. Kingii,** Watson, l. c. Very low and tufted, 1 to 3 inches high, nearly glabrous; sheaths ciliate, dilated; leaves 6 to 9 lines long: panicle short, spicate, usually sheathed at base; spikelets few: glumes 3½ lines long, acuminate, purplish: lower palet of the nearly sessile florets 2 lines long, very villous at base, lobes rounded at the apex, lateral nerves marginal and but very shortly produced: upper palets one-half shorter, oblanceolate, acutely 2-lobed at the apex, the nerves obscure, marginal, and slightly ciliate; the palet of the lower florets the larger: lower palet of the perfect floret similar, but naked at base, the lateral lobes narrower and attenuate upward, the middle awn somewhat margined above the sinus; upper palet ovate, 2-lobed at the apex, the lobes rounded and irregularly short-serrate.

Nevada, on dry barren foot-hills of Trinity Mountains, *Watson, Dr. Torrey.* This has so much the aspect of *Tricuspis pulchella,* Torr., of Arizona and New Mexico, that it may be passed over for that species in localities where it grows.

41. TRICUSPIS, Beauv.

Panicle compound, often reduced to a simple few-flowered raceme. Spikelets 3–12-flowered, the uppermost floret imperfect or abortive; florets separated by the short joints of the rhachis, which are bearded throughout or just below the florets. Glumes membranous, 1-nerved. Palets membranous, the lower convex, 2-cleft, 3-nerved, conspicuously bearded on the nerves, the lateral nerves marginal or nearly

so, and usually excurrent as brief awns or points, the central one distinctly exserted. Upper palet much shorter, 2-toothed and ciliate-margined. Stamens 3. Scales 2, truncate or emarginate. Stigmas elongated, plumose. Grain oblong, smooth, free.

A genus of which there are 4 or 5 species in the Eastern States, and a much larger number belong to the flora of Texas and Mexico. The species are in much confusion, and have been placed under *Uralepis, Windsoria, Triplasis, Trichodia*, and other genera.

1. **T. pulchella**, Torr. Low tufted annual or biennial, the crowded wiry culms 2 to 6 inches high, fasciculately branched above: leaves setaceously convolute, cuspidate, rigid, scabrous; sheaths short, open, striate, with wide scarious margins and villous at the nodes; ligule a ciliate fringe; radical leaves crowded, an inch long, the upper less than half as long, some reduced to 2 or 3 lines in length and appearing like large awned glumes: panicle of about 3 spikelets, 4 or 5 lines long and 6 – 7-flowered: glumes white, acuminate or subulate-pointed, broad, the upper slightly exceeding the lower and the florets: lower palet about 2 lines long, white, densely silky-villous to near the middle, deeply bifid, with a strong awn slightly exceeding the obtuse lobes: lobes unequally divided by the light green scarcely excurrent lateral nerves, which are somewhat villous above. — Pacif. R. Rep. iv. 156. *Triodia pulchella*, HBK. Nov. Gen. i. 155, t. 47. *Uralepis pulchella*, Kunth, Enum. i. 318, and Suppl. 274.

Fort Mohave (*Cooper*); on the Colorado at various places, *Newberry*. Very common in Arizona and Northern Mexico, covering large patches of the most sterile ground, and extending eastward to Utah, New Mexico and Western Texas.

42. DACTYLIS, Linn. Orchard Grass.

Panicle sometimes dense, usually branched and one-sided, bearing thick crowded one-sided clusters at the ends of its short branches. Spikelets 3 – many-flowered, the uppermost imperfect. Glumes herbaceous, the lower smaller and 1-nerved, the upper 3-nerved. Lower palet keeled, its 5 nerves converging to an awn-like point. Stamens 3. Scales 2, with an acute marginal tooth. Styles short, with plumose stigmas. Grain lance-oblong, free.

A genus of few species, or perhaps only a single one.

1. **D. glomerata**, Linn. Perennial, the culms forming at length large dense tufts 2 to 3 feet high, with broadly linear rough and somewhat glaucous leaves and scabrous sheaths: panicle 1 to 6 inches long, sometimes purplish, its branches horizontal in flower, erect in fruit: spikelets about 3 lines long, the glumes and lower palet ciliate on the keel. — Reichenb. Icon. Flor. Germ. t. 147; Nees, Gen. t. 65.

Fields, etc., *Bolander;* introduced. As Orchard-Grass in this country and Cocksfoot-Grass in England, this is highly valued as a meadow grass, and its cultivation is increasing. A native of the Old World.

43. KŒLERIA, Pers.

Panicle dense and spike-like, cylindrical, often interrupted below. Spikelets compressed, 3 – 7-flowered. Glumes membranaceous, the upper longer and 3 – 5-nerved, nearly equalling the florets. Lower palet membranaceous, keeled, 3-nerved, acutish, sometimes mucronate or bristle-pointed. Upper palet bifid or 2-toothed. Stamens 3. Scales 2, obliquely truncate. Styles short, with broadly plumose stigmas. Grain plano-convex, free.

A small genus, the number of species being estimated at 8 or 10, though over 30 have been described; mostly natives of temperate regions.

1. **K. cristata**, Pers. Perennial, with slender culms 1 to 2 feet high or more from a dense tuft of radical leaves, which with those of the culm are mostly convo-

lute, smooth or ciliate-hairy, with the sheaths retrorsely pubescent: panicle 1 to 6 inches long, sometimes very narrow, often much interrupted, with a silvery lustre; spikelets 2½ lines long, 2 – 4-flowered: glumes with broadly scarious margins: lower palet minutely scabrous, the lateral nerves indistinct, scarious except the green keel, acute or mucronate. — Kunth, Enum. i. 381, and Suppl. 315; Reichenb. Icon. Fl. Germ. t. 93. *K. nitida*, Nutt. Gen. i. 74.

Vicinity of San Francisco (*Bolander*); Santa Inez (*Brewer*); northward to Oregon (*Howell*), and as far eastward as Pennsylvania. It is so variable in the size and density of the spike-like panicle that it is difficult to designate varieties. Dr. Gray places *K. nitida*, Nutt., as variety *gracilis* of the species, but our specimens collected by Nuttall have a very short, rather than a "very long" spike, as given by Gray for the variety. Prof. Brewer's specimens from Santa Inez, with the panicle an inch wide, have the spikelets light brown and tinged with purple, depriving them of the silvery appearance generally so characteristic of the plant.

44. EATONIA, Raf.

Panicle contracted, or loose and slender. Spikelets mostly 2-flowered, with an abortive rudiment or pedicel, mostly smooth. Glumes very dissimilar, the lower narrowly linear, keeled, 1-nerved; the upper somewhat longer, broadly ovate, folded around the florets, 3-nerved and scarious-margined. Lower palet oblong, obtuse, compressed-keeled, naked, chartaceous; upper palet thin and hyaline. Stamens 3. Scales 2, truncate. Grain linear-oblong. — Slender perennials, with simple tufted culms, flat lower leaves, and small pale green (rarely purplish) spikelets.

Two species are known, common in the Eastern States, one of them extending to the Pacific.

1. **E. obtusata**, Gray. Culm 1 or 2 feet high: leaves 4 to 6 inches long and with the sheaths smooth or pubescent: panicle 4 to 6 inches long, its short erect branches densely many-flowered, sometimes interrupted; spikelets slightly over a line long, on short minutely roughened pedicels: glumes scabrous on the keel, the upper one truncate-obtuse; floret oblong-lanceolate, narrowed at base. — *Aira obtusata*, Michx. *A. truncata*, Muhl. *Kœleria truncata*, Torr. Fl. N. York, ii. 469, t. 150. *Reboulea gracilis*, Kunth, Enum. i. 369, and Suppl. 305, in part.

Near Mono Lake (*Bolander*); mountains of Northern Nevada (*Watson*); Oregon (*Spalding*); Arizona (*Rothrock*); and eastward across the continent.

45. MELICA, Linn. Melic-Grass.

Panicle sparingly branched, sometimes narrow, rarely racemose and secund. Spikelets 2 – 8-flowered; sterile flowers (1 to 3) much the smaller and convolute together at the top of the spikelet. Glumes membranaceous, equalling or shorter than the florets, mostly obtuse, convex, 3 – 5-nerved, the upper 5 – 9-nerved; lateral nerves vanishing within the broad scarious margin, often united by delicate cross-veinlets. Florets somewhat distant. Lower palet at length subcoriaceous, rounded or flattish on the back, 5 – many-nerved, the scarious tip usually blunt and entire or 2-toothed; central nerve ceasing below the apex or more or less excurrent; upper palet 2-nerved, ciliate above, emarginate or 2-toothed. Stamens 3. Scales fleshy, mostly united. Stigmas plumose, branching. Grain terete, loosely enclosed. — Fibrous-rooted perennials, the culm sometimes bulb-like at base: roots often tomentose: leaves mostly flat, often soft.

Widely distributed throughout temperate and subtropical regions. Over 50 species are described, though there are probably not half so many. The addition of several Californian species requires a modification of the character to avoid making two or three new genera. The enlargement of the base of the culm is in some species very striking, the bulbs being sometimes an inch in diameter. The minute cross-veins connecting the nerves of the glumes seem to be quite constant in the Californian species, and may sometimes be observed in the palets.

* Glumes nearly equalling the florets: lower palet scarious-margined, mostly obtuse and entire at the apex.

Spikelet of one perfect flower (rarely 2) and a short-pedicelled sterile one. 1. M. IMPERFECTA.
Spikelets with 2 to 4 perfect flowers.
Panicle racemose and secund: spikelets membranous: not bulbiferous. 2. M. STRICTA.
Panicle dense, spike-like above: spikelets membranous: sterile floret hooded: culm bulbiferous. 3. M. BULBOSA.
Panicle spreading, few-flowered: florets coriaceo-herbaceous: bulbiferous. 4. M. FUGAX.

* * Glumes distinctly shorter than the lower floret: lower palet acute or long-acuminate, or often notched or truncate and bifid, pointed or awned.

Lower palet merely notched or bifid, with a brief point or manifest awn.
Culm bulbiferous: lower palet acute: awn less than a line long. 5. M. BROMOIDES.
Culm not bulbiferous: lower palet truncate and 2-toothed or 2-lobed.
Lower palet conspicuously ciliate below, mostly short-awned. 6. M. HARFORDII.
Lower palet with only a few stiff marginal hairs at base: awn from below the tip, half its length or more. 7. M. ARISTATA.
Lower palet ending in a long setiform acumination: culm bulbiferous. 8. M. ACUMINATA.

§ 1. *Glumes nearly or quite equalling the florets: lower palet scariously margined, obtuse and entire at the apex: sterile floret clavate, hooded, or like the others but smaller.* — MELICA proper.

1. **M. imperfecta,** Trin. Culms tufted from strong fibrous roots, 1 to 3 feet high, slender: leaves narrow, long-acuminate, from smooth to very scabrous and pilose-pubescent: panicle 8 to 12 inches long, rays in remote fascicles, very unequal (1 to 3 inches long), the shorter densely flowered to the base; spikelets 2 lines long, minutely scabrous, 1-flowered with an imperfect floret: glumes 3-nerved, the upper and larger indistinctly 5-nerved: lower palet rather acute, strongly 7-nerved, usually purplish above except the scarious margin; upper palet about as long, 2-toothed: sterile flower short-pedicelled, two-thirds as long as the perfect one, sometimes enclosing a second. — Mem. Acad. St. Petersb. 1840, 59, and Icon. Gram. t. 355; Bolander, Proc. Calif. Acad. iv. 101. *M. colpodioides,* Nees, Tayl. Mag. Nat. Hist. i. 282. *M. panicoides,* Nutt. Pl. Gamb. 188.

Var. **flexuosa,** Bolander, l. c. Branches of the few-flowered simple panicle generally in pairs, widely spreading, often reflexed: florets larger, acute, paler and more coriaceous.

Var. **refracta.** Densely velvety pubescent throughout: panicle slender, flexuose, the few distant few-flowered rays all strongly refracted: flowers very acute.

In various localities, from San Diego northward to Oregon; the first variety on the road from Mariposa to Clark's (*Bolander*), and Santa Inez Mission (*Brewer*, n. 569); the second near San Bernardino, *Lemmon.* Exceedingly variable in size and appearance. Sometimes both the glumes and florets are blackish-purple while their shining scarious margins are bronzed; specimens from Los Angeles are pale straw-color throughout. Had it priority, Nuttall's name for the species would be preferable as descriptive, the spikelets having a strong resemblance to some Panicums.

2. **M. stricta,** Bolander. Densely tufted, 1 or 2 feet high: leaves mostly four, 4 to 6 inches long by 2 lines wide at the subauriculate base, rarely scabrous above and slightly hairy beneath, with a convolute rigid point and densely velvety-pubescent sheaths: panicle 4 to 6 inches long, about 12-flowered, resembling a simple secund raceme, the mostly solitary erect capillary rays 1–4-flowered; spikelets mostly pendulous, 6 to 8 lines long, with 2 to 4 membranous scabrous perfect flowers: glumes nearly equal, narrowed below, acute, 5-nerved: lower palet 6 lines long, unequally 5-nerved, the lateral nerves connected by cross-veinlets: upper palet half as long, emarginate, softly ciliate: neutral floret similar but much smaller. — Proc. Calif. Acad. iii. 4, and iv. 104; Watson, Bot. King Exp. 384.

In the Sierra Nevada (*Brewer, Bolander, Lemmon*), and frequent in the mountains of Nevada. Though generally densely pubescent, some of the Nevada specimens are strongly scabrous. Lemmon's specimens have the scarious sheaths at the base very dark purple, and the spikelets beautifully tinged below with the same color but otherwise of a rich light brown, presenting a marked contrast to the usual notably pale and colorless condition. This species does not make a bulb, but the lower node is swollen and solid, and tunicated with sheaths as in bulbous forms.

3. **M. bulbosa**, Geyer. Culms 1 to 3 feet high, enlarged and bulb-like at base; roots woolly-pubescent: culm leaves 3 to 6 inches long, setaceously convolute, and like the sheaths nearly smooth or scabrous: panicle 4 to 8 inches long, narrow and spike-like above, interrupted below; rays erect, mostly in pairs, very unequal, the shorter densely flowered throughout; spikelets with 2 or 3 perfect flowers, about 4 lines long, shining: glumes membranous, broad, obtuse, the lower 3 – 5-nerved, the upper 5 – 7-nerved: lower palet 3 or 4 lines long, scarious-margined, minutely scabrous, 7-nerved, the unequal nerves all ceasing below the broadly hyaline obtuse apex; upper palet ciliate on the strong keels: sterile floret often double, the uppermost minute and hooded. — Hook. Journ. Bot. viii. 19; Gray, Proc. Amer. Acad. viii. 409. *M. poæoides*, Torr. in Pacif. R. Rep. iv. 157, not Nutt.; Thurber, Bot. Wilkes Exp. 491; Bolander, l. c. iv. 101; Watson, Bot. King Exp. 383.

Santa Inez (*Brewer*, n. 569), and northward in the Coast Ranges and Sierra Nevada to Oregon, and eastward to Wyoming. Very variable and presenting some puzzling forms especially in the character of the panicle. Bolander makes a variety *inflata* upon what appears from the description to be a very large many-flowered form. The original *M. poæoides* of Nuttall is probably an *Atropis*, as indicated by Dr. Gray, l. c.

4. **M. fugax**, Bolander. Culms 1 or 2 feet high, much enlarged and bulb-like at base, slender, wiry, and with the foliage pubescent or scabrous; roots sparingly tomentose: leaves 2 or rarely 3, the uppermost and longest 4 to 6 inches long by a line wide, often setaceously pointed: panicle simple; rays remote, soon horizontal, 1 – 6-flowered, the lower clustered and unequal; spikelets 3 or 4 lines long, of 3 to 5 perfect florets, terete becoming somewhat zigzag, soon deciduous: glumes obtuse, with wide scarious margins, 3 – 5-nerved, the upper a third larger, shorter than its floret: lower palet 2 lines long, herbaceo-coriaceous, strongly 7-nerved, only the midnerve reaching the narrowly scarious apex; upper palet slightly shorter, minutely ciliate: sterile floret similar in texture. — Proc. Calif. Acad. iv. 104. *M. Geyeri*, Thurber, l. c., 492, not Munro. *Glyceria bulbosa*, Buckley, Proc. Philad. Acad. 1862, 95; Gray, same, 335.

In the Sierra Nevada from Lake Tahoe to Oregon; Cascade Mountains, *Pickering*. Intermediate between *Glyceria* and *Melica*, and long ago referred by Nuttall to the former genus under the name which Buckley afterwards published as his own. Much of the confusion among these species has resulted from the failure of collectors to gather roots with their specimens. Lemmon's excellent specimens show that in this species at least there is a contorted rootstock bearing the bulbs and the remains of the growth of several years.

§ 2. *Spikelets of 3 to 8 perfect florets, the lower exceeding the glumes: lower palet prominently 7-nerved, apiculate or distinctly awned by the excurrent midnerve at the notched or bifid or narrowly truncate or rarely long-attenuate tip.* — BROMELICA.

Bromus-like grasses, with culms 2 to 5 feet high, all except the first with coarse fibrous roots and tomentose rootlets. Leaves flat, sometimes convolute above, and with the sheaths scabrous or hairy; ligule short, very thin and mostly lacerate. Panicle with erect or sometimes spreading very unequal remotely clustered few-flowered rays, the upper rays and spikelets mostly solitary. Lower palet more or less herbaceous or coriaceous and scariously margined.

5. **M. bromoides**, Gray. Culms bulbous at base, very leafy: leaves sometimes 6 lines wide, the uppermost 1 or 2 inches long: spikelets about 8 lines long, of 4 or 5 perfect florets: glumes ovate, acutish, the upper often irregularly notched: lower palet 4 lines long, narrowly margined, minutely scabrous, lanceolate, acute, with 2 narrow ciliate teeth, the three principal nerves running to the apex, the midnerve ending as a point between the teeth or slightly prolonged; upper palet one-fourth shorter, minutely 2-toothed, ciliate on the nerves. — Proc. Amer. Acad. viii. 409. *M. Geyeri*, Bolander, Proc. Calif. Acad. iv. 103, not Munro Ms. *M. poæoides*, var. *bromoides*, of Bolander's distribution (n. 6119).

In the Coast Ranges and Sierra Nevada from San Francisco and Mount Dana (*Bolander*) to Oregon, *Howell*. Bolander states that the bulbs shrink greatly in drying and that when fresh they are often an inch in diameter. As compared with the two other more or less awned species,

this has a longer looser spikelet with the narrower and acuter glumes much shorter in proportion to the florets, and the palet also more acute, while *M. Harfordii* has the lower palet ciliate, and *M. aristata* a longer awn and the palet blunter and more broadly scarious.

6. **M. Harfordii,** Boland. Culms subgeniculate at one or two of the lower nodes, which are somewhat swollen: leaves glaucous, smooth, or scabrous above, long-acuminate, the uppermost 6 inches long, about 2 lines wide, auriculate and cartilaginous at the union with the sheath, where they are often strongly ciliate: panicle very pale, narrow; spikelets 6 to 8 lines long, 4–8-flowered: lower palet 4 lines long, strongly scabrous-pubescent, and ciliate with long shining hairs for two-thirds of the margin below; midnerve merely reaching the truncate notched narrowly-scarious often bifid apex, or excurrent just below it as a point or as a distinct awn a line or more long; upper palet about one-fourth shorter, finely ciliate on its strong nerves and scabrous between them. — Proc. Calif. Acad. iv. 102.

In the Coast Ranges (Redwoods, Mattole River, *Bolander*) and in the Sierra Nevada, *Bolander, Lemmon.* The slender and rigid culms for 2 or 3 inches of the base are clothed with scarious often dark purple sheaths. The height (3 to 6 feet) as given in Bolander's description is probably a typographical error. Lemmon's specimens, with nearly muticous spikelets, show that characters in this genus drawn from the awn are not very constant. The long hairs on the margins of the lower palet readily distinguish this from any awnless form of the next.

7. **M. aristata,** Thurber. Culms more leafy than in the preceding: leaves linear-lanceolate, the lower 4 inches long and 3 lines wide, the uppermost half as long, auriculate and cartilaginous at base: spikelets pale or purple, perfect florets mostly 3: lower palet 5 lines long, with a few stiff marginal hairs near the base, very scabrous, the central nerve excurrent just below the bifid tip as an awn 3 to 5 lines long, one at least of the other nerves nearly reaching the tips of the lobes; upper palet one-fourth shorter, strongly ciliate at top and a short distance below: imperfect floret usually awned. — Bolander, Proc. Calif. Acad. iv. 103.

In the Sierra Nevada, *Hillebrand, Bolander,* n. 4861. With a similar general appearance to the preceding, this has much shorter and broader leaves and a fewer-flowered panicle; the awn appears to be constant. Should awnless forms occur, the absence of the conspicuous line of hairs on the margins of the lower palet will distinguish it. Sheaths at base dark purple.

8. **M. acuminata,** Bolander. Root tuberous: leaves 5 to 6 lines wide at base and long acuminate, the upper very narrow, scabrous; ligule a coarse fringe: capillary pedicels with a small unequal callus-like swelling just below the elongated loosely flowered spikelets; perfect florets about 5, distant upon the flexuose rhachis: glumes very acute, scabrous on the keel and minutely ciliate toward the apex, the upper not one-fourth as long as the lower floret: lower palet 6 lines long, attenuate into a narrow setiform point, with a very narrow ciliate margin, hirsute especially below with scattered hairs; upper palet about half the length of the other, densely ciliate for its upper half and at the narrowly truncate tip. — Proc. Calif. Acad. iv. 104. *Festuca subulata,* Bong. Veg. Sitch. 173. *Bromus subulatus,* Griseb. in Ledeb. Fl. Ross. iv. 358; Gray, Proc. Amer. Acad. viii. 410. *M. poæoides,* var. *acuminata,* of Bolander's distribution, n. 4698.

Redwoods, Mendocino County (*Bolander*); Oregon (*Hall*), and northward to Alaska.

46. DISTICHLIS, Raf. Spike-Grass.

Panicle densely spiked. Spikelets diœcious, many-flowered, compressed, short-pedicelled. Glumes herbaceous or membranous, narrow, keeled, faintly many-nerved. Lower palet somewhat coriaceous, indistinctly many-nerved, acute. Upper palet with infolded margins, and prominent or narrowly winged keel. Stamens 3. Scales broad. Ovary smooth, stalked, tapering upward: styles very long with stigmas exserted from top of palet. Grain obovoid, free, with a thick spongy pericarp. — Perennials with widely creeping rootstocks and short culms clothed to the top with

crowded sheaths; leaves rigid, mostly involute. Pistillate spikelets much more rigid than the staminate. — *Demazeria*, Dumort. *Brizopyrum*, Link.

A small genus separated from *Poa* on account of its many nerved coriaceous palets.

1. **D. maritima**, Raf. Culms 6 to 18 inches high, sometimes branched below: leaves about 4 inches long, usually distichously spreading, long-acuminate: spike oblong, 1 to 3 inches long; spikelets 4 to 6 lines long, 5–12-flowered: florets smooth, excepting the minutely ciliate keels of the upper palet. — Journ. Phys. lxxxix. 104; Benth. Fl. Austral. vii. 637. *Uniola spicata*, Linn. *Festuca distichophylla*, Michx. *Brizopyrum Americanum*, Link, Hort. Berol. i. 160. *Brizopyrum boreale*, Presl, Rel. Hænk. i. 280. *Poa Michauxii*, Kunth, Enum. i. 325. *Brizopyrum spicatum*, Hook. & Arn. Bot. Beechey, 403; Gray, Manual, 628.

Var. **stricta.** Leaves setaceously convolute: panicle loose; spikelets few, erect, often an inch long, 10–20-flowered. — *Uniola stricta*, Torr. in Ann. Lyc. N. York, i. 155, and Marcy's Rep. 301, t. 20. *Uniola multiflora*, Nutt. Fl. Ark. 148. *Brizopyrum spicatum*, var. *strictum*, Gray.

The typical form at San Francisco (*Bolander*), San Luis Obispo (*Brewer*), and common on the Atlantic coast, usually near salt water. The variety at the sink of the Mohave (*Cooper*), in Puerto Cañon (*Brewer*), and the prevalent grass in alkaline localities through the interior to the Rocky Mountains and southward into Mexico. Exceedingly variable; specimens from the coast are yellowish throughout with short spikelets, while inland localities furnish forms with very long erect spikelets and the plant usually green. Torrey's *U. stricta* was founded on an extreme form with very long erect spikelets. Sometimes the culms bear clusters of arrested hardened sheaths, appearing like one-sided cones, probably due to the wound of some insect. *Brizopyrum Douglasii*, Hook. & Arn., which resembles this in little save in being diœcious, is referred to *Poa*.

47. LOPHOCHLÆNA, Nees.

Panicle a simple elongated virgate secund raceme. Spikelets long, narrow, many-flowered, compressed. Rhachis breaking up at maturity, undulate, smooth, its joints less than half the length of the florets. Glumes shorter than the lowest florets, membranous, the lower 1-nerved, the upper and larger 3-nerved. Lower palet herbaceous, becoming chartaceo-coriaceous, narrowed below to a rounded smooth callus, scarious and 2-lobed or truncate at apex, prominently 7-nerved, the midnerve produced as a straight rigid awn. Upper palet nearly equal, the central portion similar in texture to the lower, the margin and apex scarious, strongly 2-nerved and 2-keeled, folded between the nerves, and the margins strongly infolded, the nerves with a simply or lacerately toothed wing-like appendage. Stamens 3, violaceous (at least in the first species). Scales short, fleshy, connate. Ovary smooth, ovoid, stipitate: styles very long, divergent, plumose near the apex. Grain somewhat triangularly compressed, strongly furrowed: pericarp loose, 2-horned with the bases of the stigmas. — Tayl. Ann. Nat. Hist. i. 283.

Soft and smooth annuals, of which two species are known, with somewhat the appearance of a *Bromus*. The conspicuously toothed marginal wings upon the upper palet distinguish this from all our other genera.

1. **L. Californica**, Nees, l. c. Culms tufted, about 2 feet high, constricted and dark colored at the nodes, clothed below by the overlapping sheaths: lower leaves 4 to 6, the upper 1 or 2 inches long, obtuse, about 2 lines wide, barely roughish; ligule 3 lines long, very thin, acute: panicle 6 to 9 inches long, of 6 to 12 suberect or spreading spikelets about an inch long, on stout flattened pedicels a third as long: glumes colorless and shining except the nerves, the upper irregularly notched at apex: lower palet 3 lines long, the rough awn as long, very scabrous on and between the nerves; the three central nerves uniting above, the others evanescent; upper

palet rough on the green portions, the appendage to the keels with one prominent acute tooth and several irregular smaller ones. — Hook. & Arn. Bot. Beechey, 403, t. 95; Bolander, Trans. Calif. Agric. Soc. 1864 – 65, 140. *Lepitoma brevifolia*, Torr. Ms., and *Pleuropogon Douglasii*, Trin. Ms.; Steud. Gram. 292.

Oakland, Santa Rosa Valley, Ukiah (*Bolander*, n. 1545, 6075); Walnut Creek (*Brewer*, n. 1043), in wet meadows. Stems very weak, the foliage, etc., pale greenish yellow; spikelets often purplish. When young the glumes and tips of the palets, in the dried plant, shine with a silvery lustre, adding much to the beauty of the specimens. Mr. Bolander states that animals are very fond of it, and he regards it as the only certainly indigenous grass deserving the attention of agriculturists.

2. **L. refracta**, Gray. More robust than the preceding, culms 3 to 4 feet high: lower leaves 8 to 10, the uppermost 1 or 2 inches long, 3 to 4 lines wide: axis of raceme very slender; spikelets refracted by the curving of the pedicels, 1 to 1½ inches long, more loosely flowered than in the preceding: lower palet 4 lines long, barely scabrous, more or less truncate (but not 2-lobed) and erose-toothed at apex; awn about 3 lines long; appendage to upper palet with but a single blunt tooth on each side. — Proc. Amer. Acad. viii. 409.

Oregon, *E. Hall*. Plant much larger than any form of the foregoing, with the foliage much darker green, though the spikelets are similarly pale. Should be looked for in the northern part of the State.

48. GLYCERIA, R. Br. Manna-Grass.

Panicle loose, sometimes narrow, often secund, the rays semi-verticillate. Spikelets 3 – many-flowered, terete or somewhat flattened, the florets mostly early deciduous by the breaking up of the jointed rhachis. Glumes membranaceous, persistent, 1 – 3-nerved, unequal, unawned, shorter than the florets. Lower palet becoming somewhat cartilaginous, rounded on the back, smooth, the 5 to 7 parallel nerves not reaching the obtuse (rarely acute) scarious and sometimes obscurely-toothed apex. Upper palet about equalling the other, ciliate on the nerves, entire or bifid. Stamens 2 or 3. Scales 2, sometimes connate, fleshy, truncate. Ovary smooth. Styles 2, short, the stigmas plumose with much branched hairs. Grain oblong, smooth, inclosed in the palets but free from them. — Perennial smooth marsh grasses, mostly with creeping rootstocks and generally with closed sheaths.

A genus belonging mostly to temperate and cold climates; the number of species estimated at 20. Retained by some botanists with *Poa*, from which it mainly differs in its rounded smooth lower palet and its deciduous florets.

1. **G. fluitans**, R. Br. Culms 2 to 5 feet high from a widely creeping rootstock, flattened: leaves often floating, 2 to 4 lines wide and with the sheaths mostly smooth: panicle 1 to 2 feet long, spreading or generally the few long erect rays racemose, with few spikelets; spikelets ½ to 1 inch long, terete (except when flowering), erect, those on the rays mostly short-pedicelled, 7 – 20-flowered: glumes green-keeled, otherwise hyaline and nerveless, the larger upper one eroded at tip, more than half as long as its floret: lower palet 1½ to 2 lines long, 7-nerved, slightly scabrous, its broadly scarious subacute tip entire or obscurely 3-lobed; upper palet 2-toothed, slightly shorter or sometimes a little longer: scales united and fleshy. — *Festuca fluitans*, Linn. *Poa fluitans*, Scopoli.

Sierra Nevada (*Lemmon*, *Mrs. R. M. Austin*); Oregon (*Hall*); Europe, Asia, Africa and Australia. Found in shallow water in ponds and ditches, its leaves often floating, usually very pale green with the spikelets sometimes purple-tipped.

2. **G. nervata**, Trin. Culms 2 to 4 feet high: leaves variable, often ample, sometimes 12 to 15 inches long and 4 to 6 lines wide, usually roughish above, as are the closed sheaths: panicle 4 to 8 inches long, its flexuose capillary rays in twos or threes, erect when young, soon diffusely spreading and pendulous; spikelets ovate-

oblong, 5 – 7-flowered, 1 or 2 lines long, sometimes purplish: florets about a line long, closely imbricated, early caducous: lower palet prominently 7-nerved, fine-scabrous, strongly convex near the truncate-obtuse apex; upper palet about as long as the other, minutely 2-toothed at apex, the margins broad and infolded. — *Poa nervata*, Willd. *P. striata*, Michx. *Briza Canadensis*, Nutt. Gen. i. 69, not of Suppl. *G. Michauxii*, Kunth.

In Mendocino County and in the Sierra Nevada (*Bolander*, n. 2256, 3908); Big Tree Grove (*Hillebrand*); Oregon, etc. Found in moist meadows and along water-courses from the extreme east westward. Sometimes called "Fowl Meadow-Grass," a name which should not be used for this grass, as it properly belongs to *Poa serotina*. It is regarded as a valuable component of moist pastures.

3. **G. pauciflora**, Presl. Culms 1 to 3½ feet high from a creeping root, smooth: leaves 3 to 12 inches long, 3 to 6 lines wide, acute, scabrous on the margin; ligule about 3 lines long, rounded, obtuse, but soon lacerate; sheaths split, slightly longer than the internodes: panicle 6 to 8 inches long, loose, its capillary branches in threes below, in pairs above, flower-bearing from near the middle; spikelets 2 to 2½ lines long, 4 – 6-flowered: lower glume acute, 1-nerved; upper rounded, 3-nerved, less than half as long as its floret: lower palet rather more than a line long, prominently 5-nerved, scabrous, truncate-obtuse at the scarious tip, which is serrulate or distinctly toothed, more or less purplish. — Rel. Hænk. i. 257; Watson, Bot. King Exped. 384. *G. microtheca* and *G. leptostachya*, Buckley, Proc. Philad. Acad. 1862, 95, 96.

From San Francisco (*Bolander*) to Washington Territory and Vancouver Island, and in the Rocky Mountains southward to Utah and Colorado.

49. ATROPIS, Rupr.

Panicle contracted, at least with age. Spikelets few – many-flowered. Glumes 3-nerved, or the lower irregularly so or 1-nerved, much shorter than the lower florets. Lower palet chartaceous or membranaceous, rarely herbaceous, convex or flattish on the back, sometimes partially keeled, faintly 5-nerved, all but the midnerve vanishing at some distance below the broadly scarious and mostly obtuse often mucronulate or denticulate apex. Upper palet with converging ciliolate nerves and a 2-toothed or bifid apex. Stamens 3. Scales ovate, toothed on the outer margin. Styles short, the subsessile stigmas with simple hairs. Grain free, obscurely grooved. — Griseb. Fl. Ross. iv. 388. *Sclerochloa*, Beauv. *Poa* § *Atropis*, Trin. *Glyceria* § *Heleochloa*, Fries. *Glyceria* § *Sclerochloa*, Hook. f.

A small genus of perennials and annuals, differing from *Poa* especially in the rounded lower palet, and from *Glyceria* in the less prominently nerved lower palet and the simple hairs of its nearly sessile stigma. One of our species is usually (always *t*) dioecious.

1. **A. distans**, Griseb. Culms tufted from a perennial root, ½ to 2 feet high: leaves short and narrow, mostly convolute and with the sheaths mostly glaucous and smooth, save a very minute roughness near the apex; ligule oblong, distinct: panicle very variable, erect, narrow and one-sided, spreading or with age even refracted, its rays in fives or fewer; spikelets 3 to 6 lines long, 3 – 12-flowered; florets mostly somewhat distant: glumes much shorter than their florets, from narrow and acute to broad and obtuse, sometimes irregularly ciliate above, 3-nerved or the lower 1-nerved: lower palet oblong-linear, 1 to 1½ lines long, minutely pubescent at base, the lateral nerves one-fourth shorter, apex truncate, erose-toothed or subacute. — Ledeb. Fl. Ross. iv. 388. *A. maritima*, *A. angustata*, and probably also *A. convoluta* and *A. tenuiflora*, Griseb. l. c. *Poa airoides*, Nutt. *P. Nuttalliana*, Schult. *P. Nutkaensis*, Presl. *Glyceria distans*, *maritima* and *festuceformis*, Reichenb. Icon. Fl. Germ. t. 151, 152. *G. angustata* and *G. airoides*, Thurb. Bot. Wilkes Exp. 490, 491. *G. montana*, Buckl.

Eureka and near San Francisco (*Bolander*); Sierra Valley (*Lemmon*); northward to Washington Territory and east to the Saskatchewan, Nebraska and New Mexico; also on both shores of the Atlantic and in Asia. Variously referred by different authors, under numerous specific names, to *Poa*, *Glyceria*, *Festuca* and *Atropis*. With specimens from coast localities only it is not difficult to make out both *A. distans* and *A. maritima*; the forms with few-flowered spikelets in spreading panicles answering for the one, while those with many-flowered spikelets on the solitary or geminate rays of an erect and somewhat one-sided panicle correspond with the description of *A. maritima*. Specimens from numerous mountain localities sustain the view of Trinius, who under *Poa* § *Atropis* (Mem. Acad. St. Petersb. 1831, 389) places *Poa distans*, Linn., *P. maritima*, Huds., and several other related species as varieties of *P. arcnaria*, Retz. In bringing them together under *Atropis* it seems preferable to adopt one of the specific names by which they have been heretofore well known. The specimens collected by Lemmon in Sierra Valley are from 4 to 10 inches high, but with a spreading panicle, and approach in size the form which has been called *Glyceria angustata*, though in that the branches of the panicle are erect and rarely more than 1-flowered. Bolander's plant collected at Eureka is exactly the European *A. festucæformis*, while his specimens from near San Francisco and overflowed by the tides would be *A. maritima*, were not the branches of the panicle in fives; one of the chief characters given for that species being the solitary or geminate rays.

2. **A. procumbens.** Annual, its root-fibres with a copious cottony pubescence; culms sometimes decumbent at base, stout, 2 to 10 inches high, much enlarged below by the crowded withered sheaths, glaucous: leaves flat, or at most folded, those of the culm an inch long or less, about a line wide, barely tapering to the carinate scabrous apex; ligule long, acute; sheaths broad, striate, mostly flat: panicle ½ to 1½ inches long, its base exceeded by the upper sheath; rays solitary or in twos or threes, at length spreading, the few spikelets usually distichous; spikelets 2–5-flowered, subsessile: glumes half as long as the lower florets, the lower acute, its lateral nerves not extending half its length; upper broadly ovate, submucronate, 3- or indistinctly 5-nerved: lower palet 2 lines long, broad, obtuse, obscurely erose-toothed, often mucronate, strongly scabrous on the keel, the marginal nerves obscure, slightly pubescent at base; the strongly ciliate upper palet mostly equalling the lower. — *Poa procumbens*, Curt. *P. rupestris*, With. *Sclerochloa procumbens*, Beauv. *Festuca procumbens*, Kunth, Enum. i. 393 and Suppl. 328, t. 29, fig. 3.

Mendocino County (*Bolander*, n. 6467), collected with *Agrostis mucronata*, Presl, which closely resembles it in general appearance; western coast of Europe. All the specimens have dense spike-like panicles with a close resemblance to and the soft feeling of some dwarf *Alopecurus*. When the short secund branches of the panicle are expanded the plant has a widely different appearance, as is shown by specimens from the coast of England, with both conditions in the same specimen.

3. **A. Californica,** Munro Ms. Densely tufted perennial, its somewhat rigid culms a foot or more high, and the pale-green foliage minutely scabrous: radical leaves about half as long as the culm, mostly flat, a line or more wide; culm-leaves short, the uppermost often reduced to a mucro, acute-pointed; ligule short, truncate: panicle 2 to 3 inches long, contracted, or with the rays (in pairs or threes) spreading; spikelets 3–7-flowered, ovate, flattish, pale green or purplish, membranaceous, mostly dioecious: glumes acute, rough on the back, the upper broader, distinctly 3-nerved for half its length, ¾ the length of its floret, the lower irregularly 3-nerved: lower palet 2 lines long, the intermediate nerves faint, all but the central disappearing a third below the broadly scarious irregularly erose apex, the lower half of the middle and marginal nerves usually silky-pubescent; upper palet ¼ the shorter, broadly 2-nerved, with wide inflexed margins, ciliate on the nerves and narrowly truncate above. — *Sclerochloa Californica*, Munro in Benth. Pl. Hartw. 342. *Eragrostis Fendleri*, Steud. Syn. Gram. 278. *Poa andina*, Nutt. in herb. Gray (not Trin.); Watson, Bot. King Exp. 388; Vasey, Bot. Wheeler Exp. 289.

In various localities near San Francisco (*Bolander*); Monterey (*Hartweg*); and in the mountains through the interior to Colorado and New Mexico, and southward into Mexico. In the list of Hartweg's plants this was enumerated as "*Sclerochloa Californica*, Munro, sp. n." As no description was given, several have supposed that the following species was the plant intended to be thus named, and it has been distributed under the name, thus causing much confusion. Besides abundant other differences, the great dissimilarity in the foliage allows the two to be distinguished

at once. Specimens from localities near the coast generally have very pale green spikelets, while in those from the mountains, especially eastward, the florets are more or less purple, save the colorless broad margin and apex. In some specimens the lower palet is minutely scabrous and without the pubescence upon the nerves. The plant seems to be completely dioecious, the staminate florets being more acute than the others.

4. **A. tenuifolia.** Culms very slender, densely tufted, 1 to 2 feet high and with the foliage glabrous or more or less scabrous; radical tufts 3 or 4 (rarely 6) inches high, of exceedingly narrowly linear mucronate-pointed leaves; those of the culm scarcely wider, ½ to 1 inch long; ligule long, pointed: panicle 2 to 6 inches long, the erect rarely spreading distant rays mostly in threes; spikelets 2–5-(mostly 3-) flowered, usually puberulent: glumes very acute, ¾ as long as the florets, rough on the midnerve, the lower occasionally and the upper strongly 3-nerved near the base: lower palet barely 2 lines long, narrowly lanceolate, obtuse, often erose at the apex, rough on the midnerve, the other nerves reaching about ⅔ its length, puberulent or with a few scattered hairs near the base; upper about as long. — *Poa tenuifolia*, Nutt.; Buckl. in Proc. Phil. Acad. 1862, 96; Gray in same, 336, excl. syn.; Watson, Bot. King Exp. 387; Gray, Proc. Amer. Acad. viii. 409.

Frequent throughout the State, from San Diego (*Cooper*) to Oregon and northward, and east to Colorado. According to Mr. Watson this is one of the most valuable of the "bunch grasses," and the grain is collected by the natives for food. A most interesting as well as puzzling series collected by Mr. Lemmon illustrates the great variety of forms assumed by this species, but the strikingly slender leaves are conspicuous in all. In the majority, the panicle and often the whole plant is purplish, as they are in a specimen of Nuttall's *Poa tenuifolia*, communicated by the late Mr. Durand.

5. **A. pauciflora.** Culms 2 to 2½ feet high: leaves pale green, striate-nerved, finely scabrous, folded or convolute, erect and somewhat rigid; radical clusters about a foot long, narrowly linear, those of the culm wider (about 2 lines), the uppermost 1 to 3 inches long, mucronate; ligule about 2 lines long, wider than the leaf: panicle 5 to 10 inches long, very narrow, much interrupted below with one or two solitary distant rays; upper rays in twos or threes, 1 or 2 inches long, erect, with short 2–4-flowered branches; spikelets 1–2-flowered: glumes nearly equal, acute, smooth, 3-nerved at base, the upper nearly equalling the lower floret; lower palet 1½ lines long, finely scabrous throughout, the broad apex entire or barely mucronate, the lateral nerves extending about two-thirds its length; upper palet equalling the lower, strongly ciliate on the nerves.

Wet Meadows, Sierra Valley, *Lemmon*, 1871. Apparently a perennial, of which the very long narrow and somewhat rigid leaves and the slender panicle are strikingly unlike those of any other species. The plant bears a strong resemblance in color and general appearance to some forms of *Agrostis exarata*, Trin. Spikelets with one and two perfect florets are found in the same panicle; those with one perfect floret have a much larger abortive flower than the 2-flowered, in which it is often reduced to a minute point.

6. **A. scabrella.** Culm perennial, 1½ to 2½ feet high, slender, leafy and clothed below with loose sheaths, and with the leaves, sheaths and panicle minutely scabrous: leaves flat or carinately folded, the lower 6 to 9 inches and the upper about 3 inches long, scarcely over a line wide, curved-mucronate and rougher at the apex; ligule (at least the upper) 6 lines long, acute, and pubescent on its outer surface: panicle 4 to 6 inches long, narrow, somewhat dense; rays in pairs, the lower 1½ to 2½ inches long, erect, mostly branched and flower-bearing to the base; spikelets 3–5-flowered, the uppermost floret imperfect, all rather distant: glumes two-thirds as long as the florets, both 3-nerved below: lower palet 2 lines long, narrowly lanceolate, prominently 5-nerved, punctulate-scabrous all over and rough-hairy on the nerves, especially below, where the hairs are somewhat crisped; apex obscurely toothed or mucronate; upper palet slightly the shorter, 2-toothed at the apex, strongly ciliate on the nerves and scabrous between them: stamens 3: ovary abortive.

Oakland, *Bolander*. The specimens, which are without radical leaves, appear as if from a wet locality. The large anthers and abortive ovary indicate that the plant is probably dioecious. It

is unlike any other species in the peculiar roughness of the lower palet and in the character of the panicle. The pubescence upon the ligule is also something very unusual and it may prove to be characteristic of this species.

50. POA, Linn. Meadow-Grass.

Panicle generally open, its rays in pairs or in half whorls. Spikelets 2 – several-flowered, ovate or lanceolate, compressed. Glumes mostly shorter (longer in one or two species) than the lower florets, the lower 1-nerved, the upper and larger 3-nerved, acute or obtuse, keeled. Lower palet herbaceous or membrano-herbaceous with scarious margins and tip, compressed-keeled, acute, pointless (save in two or three exceptional species), 5- (rarely indistinctly 7-) nerved, the intermediate nerves often faint, usually softly hairy at base especially on the dorsal and marginal nerves, and often with crisped cobwebby hairs below. Stamens 2 or 3. Scales acute. Ovary (except in one anomalous species) smooth: styles generally very short, terminal; stigmas mostly simply plumose. Grain oblong, smooth, free.

All of our species, save one, are perennials, and one species is dioecious. They are mostly natives of cold and temperate climates, and as they generally have a wide range and vary greatly from local influences there is much confusion among them. Steudel brings together some 200 names, but the best authorities estimate the species at less than half that number. The mountain species are especially variable and present many puzzling forms. Some of the most valued pasture grasses belong to this genus.

It is probable that the student of the grasses of California will meet with species of *Poa* not here described. The various collections at hand contain several forms which no doubt belong to this genus, but the material is old and weather-worn or otherwise too imperfect for satisfactory determination.

Root annual.	1. P. ANNUA.
Root perennial: flowers perfect.	
Low tufted mountain or alpine species.	
Leaves short, flat and soft.	2. P. ALPINA.
Leaves narrowly linear or setaceous.	
Panicle lax, one-sided and nodding.	3. P. LAXA.
Panicle with few-flowered erect branches.	4. P. ABBREVIATA.
Tall (1 to 3 feet), the branches of the loose open panicle mostly in fives: florets more or less webbed at base. Meadow or woodland grasses introduced by cultivation and (except n. 6) indigenous.	
Culms with running rootstocks and emitting stolons.	5. P. PRATENSIS.
Culms tufted, without distinct running rootstocks or stolons.	
Leaves and sheaths rough.	6. P. TRIVIALIS.
Leaves and sheaths soft and smooth.	7. P. SEROTINA.
Tall; branches of the panicle solitary or in pairs.	
Panicle open, the branches slender and spreading.	8. P. STENANTHA.
Panicle narrow, the branches short and erect.	9. P. GLUMARIS.
Root perennial: flowers dioecious, in crowded ovoid heads.	10. P. DOUGLASII.

§ 1. *Root annual; culms low (rarely over 6 inches); branches of the short panicle single or in pairs.*

1. **P. annua,** Linn. Culms compressed, geniculate below, weak: leaves bright green, short, obtuse, sometimes wavy, and with the sheaths smooth: panicle often 1-sided; spikelets very short-pedicelled, 3 – 7-flowered, about 2 lines long; florets mostly hairy below the middle. — Reichenb. Icon. Fl. Germ. t. 155.

San Diego (*Cooper, Parry*); Monterey (*Brewer*); San Francisco, *Bigelow, Bolander.* Found all over Europe, in Asia, Northern Africa, Australia, etc. No doubt introduced upon the coast, but apparently indigenous in Arizona, New Mexico, Western Texas, etc. The plant from these inland localities is often a foot high with very slender culms; it has fewer and broader spikelets and is of a much paler green, but was referred by Munro to this species. Bolander's n. 1549 has larger and more prominently nerved florets than usual. This species is what is known as a winter-annual, its seeds germinating in the fall and the young plants commencing to bloom very early the next spring.

§ 2. *Root perennial: flowers perfect.*

* *Low mountain or alpine species, erect in perennial tufts.*

+ *Soft and flaccid, smooth or nearly so; leaves short and flat, short pointed; ligule elongated.*

2. **P. alpina**, Linn. Culms 6 to 18 inches high, rather stout: leaves broadly linear, 1½ to 2 inches long, the upper very short, mucronate: panicle oblong or pyramidal, 1 to 3 inches broad; spikelets broadly ovate, 3 – 9-flowered, 2 or 3 lines long: glumes ovate, acute: lower palet very hairy below, especially on the mid- and marginal nerves. — Reichenb. Icon. Fl. Germ. t. 156; Gray, Man. 629; Watson, Bot. King Exp. 386.

This and the two following species, though not occurring in any of the collections made within the State, are frequent in the mountain ranges at the north and east, and are very likely to be met with. It presents a great variety of forms, and when unexpanded appears very different from the fully developed plant.

+ + *Leaves narrowly linear or setaceous.*

3. **P. laxa**, Haenke. Culms 3 to 10 inches high, very slender, somewhat compressed: leaves narrowly linear, obliquely mucronate: panicle 1 to 3 inches long, narrow, lax, one-sided and often nodding, its branches solitary or in pairs; spikelets 2 – 4-flowered, 2 lines long, or less: glumes acuminate-pointed: florets hairy on the keels and margins. — Reichenb. Icon. Fl. Germ. t. 157.

In the Rocky Mountains (*Parry, Bourgeau*); eastward to the mountains of New York and New England.

4. **P. abbreviata**, R. Br. Culms from slender creeping rootstocks, 3 to 6 inches high: leaves convolute, filiform-setaceous, those of the copious radical tufts mostly reaching the panicle, the culm-leaves about an inch long, smooth or finely puberulent near the apex; ligule oblong, entire; sheaths very loose: panicle about an inch long, its very simple 1 – 2-flowered branches in pairs, nearly smooth; spikelets 2 to 2½ lines long, 3 – 5-flowered: glumes about half as long as the florets, acute, rough on the keel; florets rather distant: lower palet 1½ lines long, strongly keeled, with the other nerves conspicuous, rough-pubescent all over except the broad-scarious margins, more or less woolly at base. — App. to Parry's 1st Voy. 187; Steud. Syn. Gram. 253.

Washington Territory (*Pickering*); Arctic America.

* * *Tall perennials (1 to 3 feet) with open oblong or pyramidal panicles, the rather short and rough branches mostly in fives: florets acute, more or less webbed at base. Meadow grasses introduced by cultivation or (except* n. 6) *indigenous.*

+ *Culms with running rootstocks, and emitting stolons from the base.*

5. **P. pratensis**, Linn. Culm and sheaths smooth; leaves dark green, the radical very long, those of the culm short, scabrous on the margins; ligule short and blunt: panicle pyramidal; spikelets 3 – 5-flowered, somewhat crowded and almost sessile: glumes acuminate, scabrous on the keel: lower palet distinctly 5-nerved, silky-hairy on the margins and keel and webbed at base. — Reichenb. Icon. Fl. Germ. t. 161.

Near San Francisco (*Bolander*); northward to Oregon and Washington Territory and indigenous in the mountainous districts eastward to New England. This, known as "June Grass," "Green Meadow Grass," "Spear Grass," and "Kentucky Blue Grass," in various parts of the country, is one of the most highly valued pasture and meadow grasses. The limestone soils of Kentucky being especially favorable to its development, the "Kentucky Blue Grass" was for a long time supposed to be a distinct species, until it was found that seed from the celebrated "Blue-grass" pastures of that State when sown elsewhere produced only "June-grass." In Oregon this is regarded as one of the most troublesome weeds in cultivated fields, its rapid propagation by means of rootstocks and stolons, so useful when the grass is cultivated, making it very difficult to

eradicate. In common with many other grasses, this at the Northwest often has its panicles of a handsome bronze color, giving it a very different appearance from that usually borne by the species.

+ + *Culms tufted, without distinct running rootstocks or stolons.*

6. **P. trivialis,** Linn. Culms erect, from a somewhat decumbent base: leaves and sheaths rough; ligule oblong, acute: panicle with very rough and rather distant branches; spikelets mostly 3- (sometimes but 2-) flowered, broader above: lower palet distinctly 5-nerved, webbed at base, hairy only on the midnerve. — Reichenb. Icon. Fl. Germ. t. 162.

Along the Coast Ranges (*Bolander*); introduced. Known as Rough Meadow-grass, and common in the Eastern States, especially in moist meadows, though regarded as less valuable than *P. pratensis*, to which it bears a very close resemblance. It is distinguished from it chiefly by its rough sheaths, long and acute ligule, and fibrous roots.

7. **P. serotina,** Ehrhart. Leaves narrowly linear, soft and smooth; ligule elongated, acute: panicle 6 to 10 inches long, at length somewhat nodding at apex, often purplish; spikelets 2–4- (rarely 5-) flowered: glumes narrow: lower palet very obscurely nerved, slightly webbed below. — Gray Man. 629. *P. angustifolia,* Reichenb. Icon. Fl. Germ. t. 160. *P. crocata,* Michx.

Not reported from the State, but as it is frequent in the Rocky Mountains and in Washington Territory, it is likely to occur here. By some European botanists this is referred to *P. pratensis*, from which the absence of running rootstocks and the character of the panicle sufficiently distinguish it.

* * * *Tall; branches of the panicle solitary or in pairs.*

8. **P. stenantha,** Trin. Culms 1 to 2 feet high: radical leaves narrowly linear; culm leaves distant, erect, flat, 1 to 3 inches long, between 1 and 2 lines wide, ciliate-scabrous on the margin, which is somewhat cartilaginous, especially at the carinate apex where it is scabrous on the keel; ligule rounded, short: panicle 2 to 6 inches long, rays spreading, long-naked below, few-flowered above; spikelets 2–5- (even 8-) flowered; florets 2 to 2½ lines long, distant upon the flexuose or zigzag very pubescent or nearly smooth rhachis: lower palet linear-lanceolate, the edges infolded at the marginal nerve which, with the keel, is ciliate-scabrous, elsewhere pubescent or smooth. — Mem. Acad. St. Petersb. vi. ser. i. 376; Ledeb. Fl. Ross. iv. 372; Gray, Proc. Amer. Acad. viii. 409. *P. leptocoma,* Trin. l. c. *Festuca nervosa,* Hook. Fl. Bor.-Am. ii. 251, t. 232.

Oregon (*Hall*); Washington Territory (*Pickering*), and northward. No specimens are known to have been collected within the State, but it appears to be frequent at the north. The spikelets vary much in the degree of pubescence as they do in the number of the flowers. The infolding of the lower palet at the marginal nerves gives the florets an equilateral appearance that is quite characteristic. In none of the specimens at hand, from Oregon, etc., are the florets woolly at base, as described for *P. leptocoma,* Trin.

9. **P. glumaris,** Trin. l. c. 379. Culms stout, strict, 1 or 2 feet high, with radical leaves about half as tall; culm leaves 2 or 3 inches long, rigid, striate-nerved, very minutely scabrous, about 2 lines wide; ligule short, auricled: panicle 2 to 4 inches long, very narrow; rays solitary or in pairs and unequal, one bearing 1 or 2, the other 3 to 5 spikelets, smooth; spikelets 3–5-flowered, membranous: glumes ⅔ as long as the florets, smooth, broad at base, acute, erose-margined: lower palet acute, carinate at apex, 5- or indistinctly 7-nerved, pointed or rarely mucronulate at apex, puberulent throughout; upper palet equal in length, broad, coarsely ciliate on the nerves: scales as long as the ovary, lacerate and ciliate: ovary hairy above; stigmas much elongated, copiously plumose. — *Glyceria* (*Arctopoa*) *glumaris,* Griseb. in Ledeb. Fl. Ross. iv. 392. *Poa* (*l*) *Kingii,* Watson, Bot. King Exp. 387.

Virginia City, Nevada (*Bloomer*); East Humboldt Mountains, *Watson.* Not collected within the State, but common northward to Sitka, etc. A most anomalous species, which Trinius, who seems to have overlooked its ovary, scales, etc., referred to *Poa* without apparent hesitation. Grisebach in Flor. Rossica placed it in *Glyceria,* but it is so unlike the rest of the genus that he made a subgenus, *Arctopoa,* to include it. Mr. Watson doubtfully refers it to *Poa,* and notes

that it does not well agree with the generic characters. It is apparently the type of a distinct genus, but in the absence of fruiting specimens it seems better to leave it as an anomalous *Poa*. Should it prove to be generically distinct, then to avoid the multiplication of names there seems to be no objection to adopting *Arctopoa*, Griseb. None of the specimens have stamens, and the remarkable development of stigmas, which much exceed the palet and are broad as well as long, makes it probable that the plant will prove to be dicœcious. The very long and lacerate scales, as well as the hairy ovary, are unlike those in both *Glyceria* and *Poa*. The panicle is pale straw-color with an occasional faint tinge of purple. The leaves are very pale green, dry and rigid, flat except towards the apex, and with a barely perceptible roughness.

§ 3. *Spikelets dicœcious, in dense ovate heads: perennials, with long slender root-stocks, growing in shifting sands on the coast.*

10. **P. Douglasii**, Nees. Culms slender, often branched below and clothed with numerous marcescent sheaths, 6 to 12 inches high: radical leaves numerous, setaceously convolute, smooth, soft, mostly exceeding the culm; culm leaves two to five, the uppermost 2 to 4 inches long, less closely convolute, rarely flat at base, striately many-nerved and finely pubescent above; upper ligule about a line long, truncate; sheaths crowded below, the upper very loose: panicle 1 or 2 inches long, often included at the unequal base; spikelets 3–5-flowered, broadly ovate, flattened, 4 lines long and when in flower as broad: glumes ⅓ shorter than the florets, acute, ciliate on the keel, sometimes on the margin: lower palet 3 lines long, lanceolate, acute, the midnerve often mucronate-excurrent, indistinctly 5-nerved, the keel ciliate-pubescent above and with the marginal nerves softly hairy and more or less crisped-woolly below; upper palet about equal, ciliate: staminate florets with imperfect ovaries; pistillate florets with one or more abortive stamens: scales very acute: ovary long-stipitate; styles thick at base; stigmas nearly sessile, very broad below with longer hairs. — Ann. Nat. Hist. 1st ser. i. 284. *P. Californica*, Steud. Syn. Gram. 261. *Brizopyrum Douglasii*, Hook. & Arn. Bot. Beechey, 404; Torr. in Pacif. R. Rep. iv. 157.

San Francisco and Bolinas Bay (*Bolander*); Monterey Bay (*Parry*); elsewhere on the coast, *Douglas, Coulter*. The rhizomes, though scarcely larger than a pack-thread, are wonderfully tenacious; they run to a great distance, branching freely, and with their abundant clusters of leaves and flowering stems, do excellent service in binding the blowing sands. The heads in shape and color have a strong resemblance to those of Canary-Grass (*Phalaris Canariensis*). The staminate heads are usually rather smaller and lighter colored than the pistillate, which are of a very pale green. The height above given is for the culms above the rootstocks, but half or two-thirds of that is beneath the surface of the sand. In separating this from *Poa*, to which Nees originally referred it, and placing it in *Brizopyrum*, Hooker & Arnott must have relied mainly upon its dicœcious character, and could not have compared the ovaries, styles, etc., as they are widely different. In *Distichlis* (*Brizopyrum*) the styles are unusually elongated, naked for a long distance below and stigmatic with short hairs near the apex; the upper palet is convolute above, forming a channel through which they are exserted, while in this species they are exserted near the base of the palet. The scales also in *Distichlis* are broadly truncate, with the upper margin 2- or 3-lobed or notched, and the ovary is sessile.

51. ERAGROSTIS, Beauv.

Panicle spreading or narrow or variously clustered. Spikelets few – many- (2 – 70-) flowered, compressed-flattened. Glumes shorter than the florets, 1-nerved. Lower palet herbaceous, 3-nerved, unawned; upper palet shorter, prominently 2-keeled, persistent upon the rhachis after the rest of the flower has fallen. Stamens 3, with short filaments. Scales 2, subcuneate. Styles 2, elongated, plumose above. Seed ovoid or oblong, not furrowed, free. — Mostly annuals with narrow convolute leaves and sheaths often hairy-bearded at the throat.

A large genus in warm and temperate regions. Formerly included in *Poa*, from which it differs in its 3-nerved lower palet, which is without webby hairs, and in the persistent upper palet.

1. **E. reptans**, Nees. Culms prostrate, creeping, much branched from an awned root: leaves short, about an inch long, subulate-pointed and smooth or with the

sheaths bearing scattered rather long weak hairs: imperfectly dioecious; panicle varying from ovate, with solitary few-flowered spreading rays, to dense and capitate; spikelets linear-lanceolate, 1 – 10-flowered, from 2 lines to an inch long or more. — Agrost. Brasil. 514, and Fl. Bras. ii², 148. *Poa reptans*, Michx. Flor. i. 69, t. 11. *P. hypnoides*, Lam. Ill. i. 185. *P. capitata*, Nutt. Flor. Ark. 146.

Sacramento (*Pickering*); Oregon (*Howell*); common along rivers across the continent, extending to Mexico and South America. The branches are usually 2 to 5 inches high, but sometimes much shorter and so densely flowered as to hide the foliage.

2. **E. poæoides**, Beauv. Culms diffusely spreading: branches ascending from a geniculate base, 6 to 15 inches high: leaves flat, mostly smooth; sheaths with few long spreading hairs: panicle narrow, crowded, with short spreading branches: spikelets lance-linear or oblong-linear, 3 to 10 lines long, 8 – 20-flowered, often lead-colored: lower palet obtuse, the lateral nerves greenish and prominent. — Agrost. t. 14, fig. 11.

Var. **megastachya**, Gray. Sheaths mostly smooth: panicle often crowded; spikelets larger, becoming linear, sometimes nearly an inch long and whitish when old, 10 – 50-flowered; has an unpleasant odor. — Man. 631. *E. megastachya*, Link. *Briza Eragrostis*, Linn.

San Francisco; Monterey, *Haenke*. A native of Europe and introduced as a common weed in nearly all parts of the Eastern States. So variable and changing so much with age that it is often difficult to distinguish between the type and the variety.

3. **E. alba**, Presl. Culms 12 to 18 inches high: leaves narrow, setaceously convolute at apex, the uppermost equalling the panicle: panicle 6 to 10 inches long, included at base, dense and somewhat spike-like, the rays erect; spikelets about 2 lines long, on shorter pedicels, 5 – 15-flowered, pale straw-color: lower palet ¾ line long, rough on its prominent nerves, of which the middle one is excurrent as a minute point. — Rel. Haenk. i. 279; Thurber in Bot. Wilkes Exped. 489.

Monterey (*Haenke*); Tulare Valley (*Heermann*); Kern River (*Blake*); Sacramento, *Pickering*. Does not appear to have been met with by any of the collectors of the State Survey. All the specimens, of different ages, are pale straw color throughout. The point of the lower palet is present or wanting on the same specimen.

52. STENOCHLOA, Nutt.

Panicle narrow, somewhat spike-like. Spikelets small, 2 – 3-flowered, all fertile, readily deciduous, the lowest with a brief callus, the others slightly separated by joints of the smooth rhachis. Glumes herbaceous, narrow and acute, the lower 1-nerved, the upper 3-nerved and slightly the longer, both much exceeding the florets. Lower palet ovate, obtusely keeled, indistinctly 5-nerved, the outer nerves marginal, herbaceo-membranaceous, with a brief scarious tip, pubescent especially on the marginal nerves and keel, minutely punctulate. Upper palet narrow, strongly 2-carinate, nearly equalling the other. Stamens 3; anthers minute. Scales 2, very small, obliquely truncate. Ovary short-stipitate: styles very slender, loosely plumose nearly to the base. Grain somewhat triangular; pericarp loose: embryo minute. — Low tufted annuals, with the florets somewhat like *Poa* and with exceedingly long and narrow glumes. — Plant. Gamb. 189.

1. **S. Californica**, Nutt. l. c. Culm from a few inches to a foot high and with the strongly striate sheaths smooth: leaves about 2 inches long, flat or folded, acuminate-pointed, ciliate-scabrous on the margins; ligule 1 line long, very thin and lacerate: panicle about 2 inches long, loosely spike-like, its erect rays mostly in pairs, densely many-flowered to the base; spikelets barely a line and a half long, very pale green: glumes spreading, with finely scabrous keels: lower palet ¾ line

long, loosely pubescent all over with appressed hairs except near the tip, the hairs on the keel and margins longer, closely appressed, forming silky lines: upper palet pubescent.

Island of Santa Catalina (*Gambel*); Guadalupe Island, *Dr. Palmer*. Until its recent discovery by Dr. Palmer, this was only known by the few specimens collected by Dr. Gambel over 30 years ago. It appears to be confined to the islands off the coast. Nuttall's description gives the lower glume as wider and 3-nerved, which is an oversight.

53. BRIZA, Linn. Quaking-Grass.

Panicle diffuse with slender branches. Spikelets many-flowered, ovate or cordate, flattish-tumid, the florets closely imbricated, mostly pendulous on capillary pedicels. Glumes subequal, rounded on the back. Lower palet roundish, entire, flattened parallel with the glumes, ventricose on the back, chartaceo-membranaceous and becoming dry, scarious-margined, many-nerved. Upper palet much smaller, ovate, flat. Stamens 3. Scales 2, ovate-lanceolate. Ovary glabrous: styles short; stigmas plumose. Grain much flattened and adherent to the upper palet.

A small genus widely spread in temperate countries. It includes both annuals and perennials, with flat leaves, and showy spikelets on slender drooping pedicels. *B. maxima*, from Asia, etc., is often cultivated as Rattlesnake-Grass for the sake of its large showy spikelets.

1. **B. media**, Linn. Perennial, its culms a foot high or more, often with much shorter flowering branches from the base: leaves thin, scabrous: panicle 2 to 4 inches long, very loose with spreading branches; spikelets 3 to 4 lines long, 5–9-flowered: glumes shorter than the lowest floret, green or purplish.

Mission Dolores, *Bolander*. Sparingly introduced, as it is in some of the Eastern States.

54. FESTUCA, Linn. Fescue-Grass.

Panicle loose and spreading or racemose and sometimes secund. Spikelets 2–many-flowered, the florets flattish or subcylindrical, not webby at base. Glumes shorter than the lower florets, membranous, acute, the lower 1-nerved, the upper and longer 3-nerved. Lower palet convex, not keeled, chartaceous or nearly coriaceous, 3–5-nerved, mucronate or awned from or near the tip. Upper palet 2-toothed, hairy on the nerves. Scales 2, notched or 2-lobed. Stamens 1 to 3. Ovary mostly smooth. Styles terminal; stigmas feathery. Grain adnate to the inclosing palet.

A genus of about 125 species, which have been arranged under several different genera; natives of arctic, cold and temperate countries, some of them of value in agriculture. It includes both annuals and perennials, of which the flowers and often the leaves are rather harsh and dry.

§ 1. *Annuals or biennials with setaceous leaves: panicle contracted or spike-like: stamens* 1 *or* 2. — Vulpia.

1. **F. Myurus**, Linn. Culms 1 or 2 feet high, slender and weak, smooth and leafy: ligule very short: panicle 4 to 10 inches long, narrow, often flexuose and one-sided, sometimes shining, branched at base, the branches appressed; upper spikelets solitary, short-pedicelled; spikelets 5–8-flowered, an inch long including awn: florets rather distant; lower glume very minute, the upper half as long as the next palet: lower palet subulate, obscurely nerved, scabrous or often slightly ciliate-hairy on the margins above, 3 lines long with a much longer awn: stamen mostly solitary. — *F. sciurea*, Nutt. Fl. Ark. 147. *F. megalura*, Nutt. Pl. Gamb. 188. *Vulpia Myurus*, Nees, Icon. Gram. i, t. 71; Reichenb. Icon. Fl. Germ. t. 130.

Monterey and Livermore Pass (*Brewer*); San Francisco (*Bolander*); and northward to Oregon, *Pickering, Bonnet*. Occurs in the Atlantic States and southward. Probably introduced. Very variable; sometimes the lower glume is barely manifest, a mere point standing in its place.

2. **F. tenella,** Willd. Culms slender, often filiform, 6 to 18 inches high, its erect leaves 1 to 3 inches long; sheaths sometimes pubescent: panicle 2 to 3 inches long, simple, often secund, the lower unequal branches in pairs, often spreading; spikelets, including awns, 4 or 5 lines long, 7 – 13-flowered, often becoming brown when old: glumes subulate, very acute, the lower at least half the length of the upper: lower palet involute, rough, about 2 lines long, exclusive of its awn, which is mostly shorter than the palet and often very brief: stamens 2. — Torr. Fl. N. York, ii. 470, t. 154, and Pacif. R. Rep. iv. 158 (var. *aristulata*).

Napa Valley (*Bigelow*); near San Francisco, etc. (*Bolander, Fitch*), and extending to Oregon, *Cronkhite.* Very common in the Eastern States, where as here it is abundant on dry hills. Torrey doubtfully referred Bigelow's specimens to this species, placing it as a variety, but it is no more unlike the typical form than are specimens from Florida. Indeed where the same spikelet has some florets twice as long-awned as others, varieties founded upon this character have little value. It extends across the country from east to west, and southward to Mexico, Texas, etc. It varies greatly in the degree of roughness of the palet, and the glumes are sometimes pubescent.

3. **F. microstachys,** Nutt. Culm slender, 4 to 15 inches high, the filiform leaves, sheaths, etc., smooth to strongly pubescent; ligule very minute: panicle 1 to 5 inches long, simple and racemose or spike-like, or with the 1-sided channelled rays spreading or sometimes deflexed; spikelets 1 – 5-flowered, on short thickened clavate pedicels, scabrous, rough-pubescent or sometimes smooth: glumes acute, the upper 3-nerved and little exceeding or twice as long as the 1-nerved lower one, and more than half equalling the floret next it: lower palet 2 or 3 lines long, with an awn 3 to 5 lines in length; upper palet with two long setose teeth, which in the older plant often project beyond the lower: stamen 1 (*Nuttall*): grain large, filling the palet, and with a very broad shallow groove, its testa dark purple. — Plant Gamb. 187; Torr. Pacif. R. Rep. iv. 156; Watson, Bot. King Exped. 388; Thurber, Bot. Wilkes Exped. 492. *Vulpia microstachya,* Munro in Benth. Pl. Hartw. 342. *F. gracilenta* and *F. pusilla,* Buckl. in Proc. Acad. Phil. 1862, 97.

Very frequent through the whole length of the State to Oregon and northward, and eastward to Nevada and Utah. Exceedingly variable, but distinguished from any form of *F. Myurus* by its larger lower glume, and from *F. tenella* by its fewer-flowered and looser spikelets and its longer more distinct awn. The spikelets, as well as other parts, present a great variety as respects pubescence; in Cooper's specimens from the Mohave desert, 1 to 2 inches high, they bear long scattered spreading hairs. Nuttall, l. c., refers to its resemblance to a *Eutriana* (*Boutelowa*), which is very strong in one of the frequent forms where the 2-flowered spikelets are divergent, as are also the 1-sided branches, while the slightly projecting teeth of the upper palet add to the resemblance. The species is quite too close to *F. delicatula,* Lagasca, a rare Spanish grass.

§ 2. *Perennials; the mostly short-awned spikelets in loose, or more or less open panicles.*

4. **F. ovina,** Linn. Culms slender, 6 inches to 2 feet high, glaucous: leaves all setaceous or the upper flat; ligule 2-lobed and auriculate: panicle short, more or less compound, somewhat one-sided, the rays mostly solitary, spreading in flower; spikelet 3 – 8-flowered, the florets somewhat distant: lower palet about 3 lines long, ternate, mucronate or with an awn less than half its own length. — Reichenb. Icon. Fl. Germ. t. 131.

Var. **duriuscula,** Gray. Taller, less densely tufted: stem-leaves often flat and sheaths pubescent: panicle more open and spikeletsl arger. — Man. 633. *F. duriuscula,* Linn.

Var. **rubra,** Gray. Less tufted, with running root-stocks: leaves sometimes flat, and with the spikelets often reddish or purplish. — Man. 633. *F. rubra,* Linn.

Var. **brevifolia,** Watson. Culms slender, 4 to 8 inches high: leaves all setaceous, and sheaths glabrous; uppermost leaves often very short and the sheaths rather loose: panicle racemose and nearly simple, erect, 1 to 2 inches long; spikelets 1 – 4-flowered, the florets terete, somewhat scabrous, about 2 lines long and twice the length of the awn. — Bot. King Exp. 389. *F. brevifolia,* R. Br.

The typical form and the var. *duriuscula* have been collected at various localities in the Sierra Nevada and elsewhere (*Bolander*, *Lemmon*), and are found in the mountains eastward to New England and far northward. The other varieties are high alpine and arctic forms, which occur in the Rocky Mountains and Oregon and northward, and are to be expected in the high Sierra Nevada. The species in one or more of its several forms is found in most mountainous countries, including New Zealand and Australia. Its foliage is not abundant but very nutritious, and it is highly valued as a pasture grass, especially for sheep.

5. **F. gracillima,** Hook. Culms 1 to 2 feet high; plant mostly smooth throughout: radical leaves copious, narrowly setaceous, reaching nearly or quite to the base of the panicle; culm-leaves mostly 2, 2 to 3 inches long, about a line wide below, very finely scabrous on the upper surface; ligule brief: panicle 3 to 4 inches long, the erect branches mostly in pairs, the lower sometimes in threes or fours, 1 – 4-flowered, the rhachis and flattened rays barely scabrous; spikelets about 6 lines long, 6 – 9-flowered: the upper and much broader 3-nerved glume about half as long as its floret, both broadly scarious-margined; joints of the rhachis scabrous-pubescent: florets 3 lines long, rather distant; lower palet with a small well-defined callus below, intermediate nerves indistinct, herbaceous with a wide scarious margin, obscurely puberulent above, acuminate and mucronate or with a distinct awn about a line long. — Antarct. Voy. 383; Steud. Syn. Gram. 312.

In the Sierra Nevada, at 8,000 feet altitude, *Bolander*. This, with the exception of being shorter awned, agrees well with specimens collected on Magdalena Island by Cunningham and named at Kew. The plant was originally collected at the Straits of Magellan. The foliage, etc., are pale green, the spikelets being sometimes slightly reddish or brownish. The awn varies greatly, the same plant furnishing both awnless and awned florets. The contrast between the almost filiform radical foliage and the flat leaves of the culms is very marked. It differs from any form of *F. ovina* in the erect branches of its fewer-flowered panicle, larger spikelets, and broader glumes having with the palets a wide scarious margin.

6. **F. scabrella,** Torr. Culms 1 to usually 3 or 4 feet high, crowded below with leafless sheaths, and twice longer than the numerous scabrous radical leaves: culm leaves rarely more than 2, the upper 2 to 8 inches long, about 2 lines wide at base, long-pointed; sheaths scabrous or rough pubescent, hairy at the junction with the blade, and subauricled with callused hairy processes; ligule a ciliate fringe: panicle 3 to 6 inches long, the lower rays distant in pairs, spreading, naked below; spikelets about 6 lines long, 4 – 6-flowered; florets rather distant: upper glume $\frac{1}{4}$ the longer and half as long as its floret: lower palet membranous, 5-nerved, rough, with a narrow scarious margin, pointed, or with an awn a line long or less; upper palet conspicuously 2-toothed, equalling or sometimes exceeding the lower. — Hook. Fl. Bor.-Am. ii. 252, t. 233; Torrey, Pacif. R. Rep. iv. 157; Boland. in Trans. Calif. Agric. Soc. 1864 – 5, 141.

Oakland (*Bolander*), also in the Rocky Mountains. The plant originally described and figured was from the Rocky Mountains, and scarcely one-fourth the size of the specimens collected within this State. A comparison of these with the original specimens in the Torrey herbarium shows them to be the same except in size. It hardly belongs to *Festuca*, and a thorough revision would probably place it with the ambiguous species of *Melica*. Among the many species of different genera known as "Bunch-grass" this is regarded as one of the most valuable, cattle being very fond of it, especially in winter. The blade of the leaf finally breaks away, leaving the sheath, a peculiarity stated by Mr. Bolander to be very constant.

7. **F. pauciflora,** Thunb. Culms 1$\frac{1}{2}$ to 3 feet high, the radical leaves about half as long; culm leaves sometimes 2 lines wide, long attenuate-pointed, and with the sheaths scabrous; ligule very short, somewhat auriculate: panicle 6 to 12 inches long, rather narrow; rays in pairs, the lower very remote, spreading, capillary, mostly branched, flower-bearing above the middle; spikelets about 4-flowered: glumes narrow, acute or somewhat obtuse, the upper about twice as large as the lower and barely half as long as the first floret; rhachis scabrous, the florets readily deciduous: lower palet 5-nerved, strongly scabrous, about 3 lines long, with a slender awn about $\frac{3}{4}$ as long; upper palet quite equalling the lower, very rough above: ovary hairy. — Fl. Jap. 52; Munro in Perry's Japan Exp. ii. 328. *F. occi-*

dentalis, Hook. Fl. Bor.-Am. ii. 249. *F. parvigluma* and *F. remotiflora*, Steud. Syn. Gram. 305 and 315.

San Francisco and Oakland (*Bolander*); Oregon (*Douglas, Pickering*); also in Japan, *Wright.* Hooker describes the glumes of his *F. occidentalis* as very obtuse: specimens collected by Douglas and communicated by Sir William Hooker to the Torrey herbarium, as compared with those collected within the State, have somewhat broader glumes, but they would hardly be described as "very obtuse." The older specimens have mostly dark purple panicles, which in the young plant are pale green.

55. BROMUS, Linn. Brome-Grass.

Panicle open, with its slender rays at length pendulous, sometimes dense or racemed. Spikelets 5–many-flowered, subterete or laterally compressed. Glumes unequal, shorter than the lowest floret, membranaceous, acute, awnless; the lower 1–5-nerved, the upper 3–9-nerved. Lower palet rounded on the back or somewhat keeled, 5–9-nerved, awned or bristle-pointed from a little below the mostly 2-cleft tip. Upper palet bifid, with ciliate nerves. Stamens 3, rarely 2. Scales entire. Ovary hairy at the tip: styles inserted just below the top and more or less lateral; stigmas feathery. Grain oblong or linear, grooved, adherent to the palet.

A genus of about 50 species; largely European, in cold and temperate portions of the continent.

* *Glumes very long and narrow, awn-pointed; lower 1-nerved, upper 3-nerved, or with an obscure additional pair: lower palet convex below, compressed-keeled above, 5-nerved, rough-ciliate on the keel. Introduced annuals.*

1. **B. maximus**, Desf. Culms 12 to 18 inches high; leaves about 3 lines wide, and with the sheaths dark green and more or less hairy: panicle erect, 5 to 8 inches long, with few erect and at length nodding 1-flowered branches; spikelets including awns about 3 inches long, 5–8-flowered: glumes hyaline except the nerves, the upper nearly equalling the floret: lower palet very rough, about 10 lines long, the teeth 2 lines and awn about 2 inches long. — Benth. Illust. Brit. Flora, fig. 1214; Reichenb. Icon. Fl. Germ. t. 142.

San Francisco, *Bolander*. A native of Southern Europe and introduced in England and other countries. This has been recorded as *B. sterilis*, Linn., which is also likely to be met with as a weed about settlements, and much resembles this. It may be known by having spikelets little more than half as large, in a very open panicle, the very slender branches of which are drooping.

2. **B. rubens**, Linn. Culm densely tufted, 6 to 9 inches high, and with the narrowly linear leaves and sheaths pale green and densely soft-pubescent: panicle ovate, 2 to 3 inches long, with very short erect branches thickened upwards and rough-pubescent; spikelets about 6-flowered, an inch long, including awns, more or less purplish: upper glume one-third the longer, and about one-fourth shorter than its floret: lower palet, like the glumes, rather coarsely pubescent, 7 lines long and 7-nerved, the intermediate nerves less distinct, terminating in two very acute hyaline teeth nearly 2 lines long, the awn rather longer than the palet; upper palet with long weak hairs. — Griseb. in Ledeb. Fl. Ross. iv. 360. *B. rigidus*, Reichenb. l. c., t. 142.

Plumas County (*Lemmon*); a native of Southern Europe. The specimens have less dark-colored spikelets, but in other respects agree with those from European localities. The root-fibres in this are pubescent.

* * *Lower glume 3–5-nerved, upper 5–7-nerved: lower palet rounded on the back: florets imbricated before expansion. Annual or biennial weeds in cultivated grounds.*

3. **B. secalinus**, Linn. Culms 1 to 4 feet high, rather rigid and with the ample leaves and sheaths smooth or rarely pubescent; panicle 3 to 5 inches long, oblong,

the branches in threes to fives and spreading even in fruit; spikelets oblong-ovate, turgid, 4 to 8 lines long, 5–10-flowered, the florets rather distant: lower palet 7–9-nerved, at length coriaceous, notched at apex, scabrous, awnless or with a variable awn less than its own length. — Torr. Fl. N. York, ii. 467, t. 157.

Plumas County, *Mrs. Austin*. Found wherever grain is cultivated; the belief that this, known as "Chess" or "Cheat," is the result of the degeneration of wheat, has been very prevalent and is still held by the ignorant.

4. **B. racemosus,** Linn. Culms 1 to 3 feet high: leaves and sheaths smooth or pubescent: panicle narrow, with branches in threes to fives, contracted in fruit; spikelets 6 to 9 lines long, 6–10-flowered, the florets closely imbricated, scabrous: lower palet 7–9-nerved, widest above the middle, bluntly angled on the margins and bifid above, decidedly exceeding the upper palet, with an awn of its own length. — Reichenb. Icon. Fl. Germ. t. 143.

San Francisco, *Bolander*. The specimens have the leaves and especially the sheaths strongly pubescent, in which it is like *B. mollis*, Linn., which is likely to be found in grain-fields, and may be known by having the spikelets also downy. Some European botanists regard this species, *B. mollis* and *B. scalinus*, all as varieties of *B. arvensis*.

* * * *Panicle with slender elongated drooping branches: florets soon separating from each other: lower glume 1-nerved, upper 3-nerved, or with an obscure additional pair. Indigenous perennials.*

5. **B. ciliatus,** Linn. Culms from 3 to 5 feet high: leaves long-pointed from a broad base, sometimes 6 lines wide, somewhat auriculate at the throat, smooth or densely pubescent, as are the sheaths; ligule short, usually a mere band: panicle compound and very loose with elongated few-flowered rays, or narrow with short mostly erect branches; spikelets about an inch long, 7–12-flowered: glumes acute, the upper more than half the length of the lowest floret: lower palet 6 to 8 lines long, 7-nerved, the central and two other nerves stronger and longer than the others, silky with appressed hairs near the margins, minutely hairy all over, or with a few long hairs on the nerves below or at the base; awn one-fourth or three-fourths its length. — Gray, Man. 635. *B. purgans*, Linn.; Hook. Fl. Bor.-Am. ii. 252, in part. *B. Canadensis*, Michx. *B. pubescens*, Muhl.

San Juan and Silver Mountain Trail, at 8–9,000 feet altitude (*Brewer*); Calaveras Grove (*Hillebrand*); near San Francisco, *Bolander*. The specimens show as many marked forms as there are localities, from perfectly smooth to densely velvety pubescent sheaths and flowers, and especially variable in the character of the panicle. The ovary in all is remarkably long-hairy at the top, while the styles are deflexed. The stiff white hairs extend a fourth of a line beyond the top of the ovary, forming a dense brush which is filled with pollen-grains; it would appear that these hairs serve as collectors of pollen, to be probably afterwards of service in some way in fertilization.

6. **B. depauperatus,** Presl. Root-fibres tomentose; culms 2 or 3 feet high, stout below: the convolute-setaceous root-leaves half as tall; culm leaves 3, distant, the uppermost 3 to 6 inches long, flat at least at base, scabrous; ligule a narrow line; sheath auricled and hairy at throat: panicle very lax and open, the long spreading capillary rays in twos, rarely in threes, few-flowered above the middle; spikelet 5 or 6 lines long, lanceolate; florets 3 or 4, distant: glumes thin and hyaline: lower palet lanceolate, soon terete, membranous, strongly scabrous, 5-nerved, barely scarious at the acute tip, awn one-fourth to a half as long; upper palet distinctly longer than the lower, scabrous above and finely ciliate: anthers very large. — Rel. Haenk. i. 263; Steud. Syn. Gram. 319.

Geysers and Pine Mountain (*Bolander*); Nutka Sound, *Haenke*. This agrees well, save in size, with Presl's description of Haenke's plant. The spikelets at first, with the florets flattened on the back, have the appearance common to the genus, but after they spread each floret becomes cylindrical and the spikelet is much like that of a *Festuca*. The anthers are very large and the ovary appears as if abortive, there being but little save the hairy crown. The plant is throughout of a very pale straw-color. It appears to have been met with only by Mr. Bolander.

56. CERATOCHLOA, Beauv.

Panicle open, with long mostly few-flowered branches. Spikelets several-flowered, much flattened. Glumes compressed-keeled, acute, shorter than the florets. Lower palet flattened, with a sharply compressed keel and a prominent callus below, several-nerved, and short-awned from the nearly entire tip. Upper palet nearly equal, strongly 2-nerved. Stamens 3, sometimes minute. Scales oval, acuminate. Ovary crowned by a hairy 3-lobed or 3-horned appendage: styles short, attached to the base of the appendage; stigmas plumose. Grain oblong, deeply furrowed, adnate to the palet.

A small American genus of tall coarse grasses, separated from *Bromus* by the much flattened entire palets and the 3-lobed tip to the ovary. Our species are usually found growing in dry places and appear to be perennial.

1. **C. grandiflora,** Hook. Culms 2 to 3 feet high, slender: culm-leaves narrowly linear, wider than those of the radical tufts; sheaths smooth, densely ciliate at least at the throat, or hirsute: panicle very loose and simple, the lower and remote cluster of 5 capillary rays unequal, flexuose-spreading, 1 – 2-flowered, the upper rays suberect; spikelets 6 – 10-flowered; florets rather distant, spreading: glumes very acute, slightly unequal, over half as long as the lowest florets, the lower 5-nerved, the upper 9-nerved: lower palet compressed-keeled, narrowed below to a short sparingly hairy callus, scabrous or strongly pubescent, 9-nerved, 8 or 9 lines long, very acute, with an awn half its length; the upper strongly ciliate, nearly equalling the lower, acuminately bifid. — Flor. Bor. Am. ii. 253, t. 235. *Bromus virens,* Buckl. in Proc. Phil. Acad. 1862, 98; Gray in same, 336. *B. Hookerianus,* Thurber, Bot. Wilkes Exped. 493.

San Francisco and elsewhere (*Bolander*); northward to Oregon (*Pickering*), and Washington Territory, *Cooper*. Bolander's specimens appear to be the typical plant of Hooker. The species varies greatly as to its pubescence on both foliage and panicle. In some plants of the same set the panicle has shorter and erect branches, while some have the lower rays not only spreading but reflexed. Hooker refers to a sort of dioecious character presented by this species. In a majority of the specimens examined the anthers are ovoid and minute, only ¼ of a line long, while the ovary is 3 lines, its hairy crown being a fifth as long. In the specimens with well-developed anthers these are over 2 lines long and the ovary but ⅔ of a line, with a hairy crown as long as before. In one case well-developed anthers and an apparently perfect ovary were found in the same floret. Field observations would show how far these points are related to other differences presented by this species.

2. **C. breviaristata,** Hook. Culm 2 to 3 feet high: leaves broadly linear, acuminate, with the sheaths rough-pubescent or hairy: panicle nearly simple, its rays in clusters of 2 to 5, erect or slightly drooping to one side; spikelets about 6-flowered, pale green, close, suberect: glumes subequal, the lower 5-nerved, the upper 9-nerved, more than half as long as the florets: lower palet 9-nerved, mostly densely pubescent, and short-awned from the usually minutely 2-toothed tip; upper palet shorter than the lower, ciliate, shortly 2-toothed. — Flor. Bor.-Am. ii. 253, t. 234. *Bromus breviaristatus,* Thurber, Bot. Wilkes Exped. 493; Watson, Bot. King Exp. 389.

Sierra Nevada (*Lemmon*), and common in the mountains of Nevada (*Watson*); northward to Oregon (*Pickering*), and Washington Territory, *Cooper*. Very variable as to pubescence of foliage, but in all the specimens the palets are closely and evenly clothed with appressed hairs, which are longer near the base. Distinguished from any erect panicled form of the last by its fewer flowered closely imbricated spikelets and the awn shorter in proportion. The specimens show minute anthers as mentioned under *C. grandiflora*, but none with long anthers have been noticed. *Bromus carinatus,* Hook. & Arn. Bot. Beechey, 403, is described as having its glumes 3 – 5-nerved and its palets 7-nerved; but as in this genus this is a character in which spikelets from the same specimen may vary, it seems probable that the species was founded upon a form of one or the other of the preceding with fewer nerves than usual. *B. carinatus* in Herb. Torrey, from Hooker, is very young, and not to be recognized as distinct from this species.

C. UNIOLOIDES, Beauv. (*Festuca unioloides*, Willd., *Bromus unioloides*, HBK., *B. Willdenovii* and *B. Schraderi*, Kunth), was at one time in high repute in France, under the name of "*Brome de Schrader*," as a forage plant from Australia; at about the same time it was cultivated in Australia as "California Prairie-Grass," and was introduced in the Southern States as "Rescue-Grass." The species is South American and is found in Texas and westward, but is not known to occur in California, notwithstanding its Australian name. It has a mostly erect panicle and minutely scabrous spikelets; the palets are very pale green above, white below, and terminated by an awn less than a line long. Specimens from Arizona have longer awns, and forms from Nevada are difficult to separate from *C. breviaristata*.

57. LEPTURUS, R. Br.

Inflorescence in filiform simple or racemed spikes. Spikelets mostly solitary and sessile, at each joint of the alternately excavated rhachis, rarely in pairs with one pedicelled. Spikelets (in our species) 1-flowered, sometimes with a second flower indicated by a minute stalk rarely bearing an imperfect floret. Glumes 2 (rarely 1), placed in front of the floret except in the terminal spikelet, where they are opposite, rigid, coriaceous, nerved or ribbed. Palets thin or membranous, the lower keeled, sometimes awned from the mid-nerve: callus minute, naked or bearded. Stamens 3 (or 1 ?). Scales 2, entire. Ovary smooth: stigmas sessile, distant and terminal. Grain free.

A small genus, chiefly of low annuals, often found on the sea-coast and in saline soils in most parts of the world.

1. **L. paniculatus**, Nutt. Culms 6 to 24 inches high, leafy below: leaves narrow with cartilaginous rough margins and point; ligule conspicuous, the loose sheaths compressed-keeled: panicle of 3 to 10 recurved secund distant spikes, the lower 3 or 4 inches long, shorter above, 3-angled and rough; spikelets 1½ to 2 lines long: glumes suddenly narrowing to awn-like points, the upper and longer barely equalling the floret, very rough on the single nerve: lower palet but partly covered by the glumes, membranous and scabrous where exposed, 3-nerved and mucronate-pointed; upper about equalling the lower, 2-toothed. — Gen. i. 81; Torrey, Pacif. R. Rep. iv. 157. *Rottbœllia paniculata*, Spreng.

Monterey (*Dr. Caufield*), and elsewhere by *Nuttall* and *Fremont;* New Mexico (*Fendler, Bigelow*); Texas (*Reverchon*), and eastward to Illinois. Plant mostly pale green, the leaves twisting spirally in drying.

2. **L. Bolanderi**, Thurber. Culms forming small tufts 2 to 5 inches high, often geniculate and with a few branches from the base: leaves 3 to 6 lines long, convolute, mucronate at apex; ligule a line or more long, acute, decurrent; sheaths loose, striate, scarious margined: spike 1 to 2 inches long, sometimes recurved, very slender; spikelets 2 to 3 lines long, single or sometimes 2 at each joint, the second spikelet on a stout grooved pedicel half its own length: glumes very thick, except at the scarious margin, the upper and slightly shorter 2 – 3-nerved, the lower 5-nerved: floret shorter than the lower glume; lower palet indistinctly 5-nerved, smooth and shining below, scabrous near the irregularly 2-toothed apex, the midnerve excurrent as an awn nearly as long as the palet; the brief callus with unequal coarse hairs about ⅓ as long as the palet; upper palet equalling or slightly exceeding the lower, rough on the nerves and 2-toothed above; rudiment very minute, plumose with hairs not exceeding those of the callus. — Bolander, Catalogue, 35.

Russian River (*Bolander*, n. 4669); Yreka, *Greene*. This was distributed by Mr. Bolander with the above name, but no description has been published. His specimens, so far as examined, had but a single spikelet at the joint. No one appears to have met with it until Mr. Greene in 1879 collected a still more slender form, the larger specimens having the spikelets in pairs. The plant is dark purple throughout, a magnifier showing the color to be disposed in minute lines. The floret with its awn, basal hairs, and rudiment, bears a strong resemblance to that of a *Calamagrostis*. The rudiment is very minute, not exceeding ⅓ of a line in length.

58. LOLIUM, Linn. Darnel or Ray-Grass.

Inflorescence a simple spike with the spikelets solitary in notches, excavated alternately on opposite sides of the rhachis. Spikelets placed edgewise to the rhachis, 3 – several-flowered. Lower glume wanting, except in the terminal spikelet, the upper facing the rhachis and persistent. Lower palet 5-nerved, awned from the tip or awnless; the upper ciliate. Stamens 3. Scales 2, rather fleshy, usually with a lateral tooth and as long as the ovary. Ovary smooth or slightly downy at tip: stigmas mostly sessile. Grain adherent to the palet.

A small genus of probably 4 species, natives of northern Europe; as they have been introduced by agriculture and naturalized in nearly all parts of the world, several times that number of species are described. The genus differs from *Triticum* only in wanting the lower glume, and in the position of the spikelet with respect to the rhachis.

1. **L. perenne,** Linn. Culms from a perennial rootstock, about 2 feet high: spike rather slender; spikelets 8 – 15-flowered, the strongly ribbed glume much shorter than the spikelet, often but little longer than the floret next to it: lower palet obtuse, merely cuspidate or short awned. — Reichenb. Fl. Germ. t. 112.

San Francisco (*Bolander*); Oregon, *Howell*. Varies greatly as to the number of florets in the spikelet and in the length of awns. *L. Italicum*, a cultivated variety of this, not known in the wild state, is a valued pasture grass, known as "Italian Ray-grass"; it has more numerously flowered and generally long-awned spikelets. *L. multiflorum*, another variety of cultivation, has very handsome spikes crowded with long many-flowered spikelets; this was collected by Mr. Howell at Sauvies Island, Oregon. Each of these varieties has several subvarieties known to cultivators.

2. **L. temulentum,** Linn. Annual, with a stout culm, sometimes 3 feet high: spikelets 5 – 7-flowered, equalled by the sharp-pointed spreading glume: florets usually very turgid and with the glumes bearing an awn longer than themselves, sometimes awnless. — Reichenb. Fl. Germ. t. 111.

San Francisco (*Bolander*); Walnut Creek (*Brewer*); San Diego, *Thurber*. As with the preceding, varieties of this have been described as species; a short-awned form is *L. arvense*, With., and an awnless one is *L. linicola*, Sonder. A specimen from Punta Arenas has branches in place of several of the lower spikelets. The seeds of this grass have long had a reputation for poisonous qualities, but experiments recorded a few years ago in the "Gardener's Chronicle" of London would show that they are innocuous, or at least not poisonous to all persons.

59. TRITICUM, Linn. Wheat.

Inflorescence in a simple continuous or more or less notched spike. Spikelets 3 – several-flowered, placed singly flatwise to the rhachis, i. e. with the edges of the florets against it. Glumes nearly equal, shorter than the florets, opposite, several-nerved. Lower palet much like the glumes, rounded on the back, 3 – 7-nerved, tapering to a point or awned. Upper palet flattened, bristly-ciliate on the nerves. Stamens 3. Scales ovate, entire, ciliate. Ovary ovate, hairy at top: stigmas sessile, distant. Grain grooved, hairy at apex, adherent to the palet.

A genus of probably 20 species, some of which are found in all temperate climates. The grain-producing *Triticums* are annuals with turgid ovate-oblong boat-shaped glumes, and are by some supposed to be derived from *Ægilops*. Botanists who hold this view place the perennial species in *Agropyrum*, Beauv.

* *Plant multiplying by long jointed creeping rootstocks: awn, when present, not longer than the palet.*

1. **T. repens,** Linn. Culms 1 to 3 feet high: leaves flat or convolute and with the sheaths very variable, from smooth to scabrous or pubescent: spikelets 4 – 8-flowered, in an erect mostly rigid spike: glumes 5 – 7-nerved, obtuse or notched, with a rigid short point or awn of variable length: lower palet similar, but nerved

only above, with an awn nearly its own length or awnless. — *Agropyrum repens*, Beauv.; Reichenb. Icon. Fl. Germ. t. 120.

San Francisco and elsewhere (*Bolander*); Oregon (*Spalding*); Washington Territory (*Cooper*); eastward to New England. A native of Europe and other temperate countries, also largely introduced as a weed. This, which is known to cultivators as "Couch-" "Quack-" and "Quitch-grass," is in its indigenous forms called "Blue-joint," "Bunch-grass," and "Lagoon-grass" by western settlers and herdsmen. It appears to be much more abundant in the Rocky Mountain region than farther west, and presents a great variety of puzzling forms, the difficulty in determining these being increased by the general lack of roots to the specimens.

* * *No running rootstock: palets and sometimes the glumes long awned.*

2. **T. caninum**, Linn. Culms 1 to 3 feet high, geniculate below: leaves flat or loosely convolute, pubescent above and like the sheaths smooth below: spike more or less nodding, at least not strict; spikelets 3 – 6-flowered, mostly much longer than the joints of the rhachis: glumes 5 – 7-nerved, with long awns or merely acuminate: florets somewhat distant; lower palet 5-nerved near the tip, with mostly spreading awns twice their own length. — *Agropyrum caninum*, Reichenb. Icon. Fl. Germ. t. 119. *Triticum ægilopoides*, Gray in Proc. Phil. Acad. 1862, not Turcz.

Big Trees, Calaveras County (*Hillebrand*); Carson's Pass, at 8,000 feet altitude (*Brewer*); frequent in Colorado and Nevada, and eastward to New England. Like the preceding very variable, and in European works several nominal species are made from forms of it. The only specimens collected within the State referable to this species are mountain forms by Hillebrand and Brewer. The latter is the same as 381 of Parry's Rocky Mountain collection of 1861, referred by Dr. Gray to *T. ægilopoides*, Turcz., but later, in the account of Hall & Harbour's plants, placed as a variety of *T. caninum*, differing from the type in its large and spreading usually much crowded spikelets and its long stout divergent awn. Brewer's specimens show a tendency to sport; in one or two cases the spike is branched below, and the spikelets are generally loose-flowered and spreading; sometimes the glumes have an occasional tooth near the tip and the lower palet is minutely 2-toothed at the beginning of the awn, varying in these respects in the same spikelet.

3. **T. violaceum**, Hornem. Culms slender, 1 to 2 feet high, and with the short mostly convolutely-setaceous leaves and sheaths usually smooth: spike 1 to 3 inches long, slender, strict and rigid; spikelets 3 – 5-flowered, usually purple-tinged: glumes with five strong rough nerves, short-pointed or briefly awned, nearly as long as the florets: lower palet strongly 5-nerved and rough above, with an awn from one-half as long to as long as itself; upper palet as long as the lower and pectinately ciliate. — Anderss. Gram. Scand. 5, t. 1, f. 6.

Silver Mountain Trail, at 8 – 9,000 feet altitude, *Brewer*. Occurs in the mountains of New England and New York, and in a few other eastern localities. The color, sometimes quite marked, is often nearly or quite lacking.

4. **T. strigosum**, Lessing. Culms from 1 to 2 feet high, slender, very densely tufted, with setaceous radical leaves half as tall, glaucous throughout; culm leaves 3, the uppermost 3 to 4 inches long, erect, reaching beyond the base of the spike, all narrowly setaceously convolute, strigose-pubescent on the upper surface, below and with the sheaths smooth or pubescent: spike 2 to 6 inches long, very slender; spikelets 3 – 6-flowered, rather distant: glumes lanceolate, strongly 3 – 5-nerved, somewhat acute, shorter than the florets, slightly scabrous on the nerves: lower palet 4 or 5 lines long, smooth below, 5-nerved near the apex and bearing a strong rough divergent awn longer than itself; upper about equal, retuse at apex and strongly ciliate. — Linnæa, ix. 170; Griseb. in Ledeb. Fl. Ross. iv. 339; Watson, Bot. King Exp. 390. *T. ægilopoides*, Turcz.; Gray in Proc. Acad. Phil. 1863, 79. *Bromus strigosus*, Bieb. *Agropyrum divergens*, Nees.

Sierra County (*Lemmon*); apparently more abundant in the mountains of Nevada and Colorado; Asia Minor, etc. Our plant agrees sufficiently with the description drawn from eastern specimens to place it here. In our plant the strigose pubescence is confined to the upper surface of the leaves and entirely concealed by their convolution; the glumes are shorter than described for the eastern plant, and are often inequilateral, with nerves upon only one side of the midrib. Bolander collected an abnormal form, with large spikelets, very distant on a flexuose rhachis, and the glumes awned or merely pointed in the same spike.

60. HORDEUM, Linn. Barley.

Inflorescence a dense spike, with three spikelets at each joint of the notched rhachis. Spikelets 1-flowered, usually with an awl-shaped rudiment of a second floret; the central spikelet of the cluster perfect and sessile, the lateral ones short-stalked and male or neuter. Glumes slender and awned or setiform, all placed in front of the spikelets, forming a kind of involucre of 6 bristles. Lower palet herbaceous, convolute about the other and long-awned. Stamens 3. Scales 2, hairy and ciliate. Ovary hairy at top. Stigmas subsessile, distant. Grain oblong, furrowed, usually adherent to the palet.

A genus of about 10 species, belonging to warm and temperate countries. Ours are biennials, with one introduced annual.

* *Glumes setaceous from a broader base.*

1. **H. nodosum,** Linn. Root perennial or probably biennial; culms 6 inches to 3 feet high, often geniculate below: leaves flat or convolute, and with the sheaths varying from nearly smooth to hairy: spike 1 to 3 inches long, narrow and readily separating into joints; the lateral neutral spikelets merely awn-pointed: glumes all setaceous: perfect floret cylindrical, 8 lines long including the awn. — Benth. Fl. Austral. vii. 669. *H. pratense,* Huds.; Gray, Man. 638. *H. secalinum,* Trin. Icon. i. 3. *H. pusillum,* Nutt. Gen. i. 87.

San Diego (*Parry, Cooper*); Monterey (*Brewer*); Oakland (*Bolander*); Oregon (*Howell*); Nevada and Utah (*Watson*); southward to Texas and eastward to Ohio. Introduced on the Atlantic coast. Very variable as to size, pubescence, etc., the specimens from San Diego being short, pale and pubescent, while those from Oregon are slender, tall, dark green and smooth. Watson states that in water, or in moist places, it reaches 3 feet in height.

2. **H. murinum,** Linn. Annual, with stems 1 to 2 feet high, smooth leaves and inflated sheaths: spike 2 or 3 inches long, inclined, compressed, usually included at base by the upper sheath; spikelets, including awns, 2 inches long: glumes of the middle spikelet lanceolate, long-awned, and conspicuously ciliate on the margins; outer glume of the lateral spikelet setaceous, the other similar to those of the central one: lateral florets longer than the central, attenuate into a long awn, scabrous above, and the inner surface covered with long weak hairs: palet of perfect floret flattened, scabrous above, its awn about three times as long and flattened below. — Reichenb. Icon. Fl. Germ. t. 117.

San Diego (*Cooper*); San Francisco, *Bolander.* Native of Europe, where it is known as "Way-bent" and "Wall Barley." Introduced in Africa and Australia.

* * *Glumes capillary throughout, very long.*

3. **H. jubatum,** Linn. Biennial, culms 1 to 2 feet high, usually smooth throughout, the margins of the leaves sometimes scabrous: spike 2 to 4 inches long, and about half as broad, the very slender rhachis readily separating; lateral florets short-awned, placed somewhat behind the perfect one, whose awn is longer than those of the glumes (about 2 inches long), spreading; spike very pale green or straw-color, shining, sometimes purplish: perfect floret 3 lines long, barely scabrous above.

Rhett's Lake (*Newberry*), and a common grass in the northern part of the State, and throughout most of the United States and northward. This is the "Squirrel Tail-grass" of the Eastern States, and would be prized as an ornamental grass did not its spike break up so readily.

61. ELYMUS, Linn. Lyme-Grass.

Inflorescence in a more or less dense spike, with 2 to 4 spikelets at each joint of the rhachis. Spikelets 1 – 7-flowered, all alike and fertile, and placed sidewise to the rhachis. Glumes mostly conspicuous, nearly equal, placed side by side, 2 in

front of each spikelet, together forming an involucre to the cluster. Lower palet mostly coriaceous, 5-nerved, rounded on the back, acute or awned at apex, stamens 3. Scales ovate, usually ciliate. Ovary hairy: stigmas sessile or nearly so, distant. Grain adherent to the palets.

A genus of perennials belonging to northern temperate regions, the number of species about 25.

* *Glumes shorter than the spikelet: lower palet cuspidate, or (in one variety) awn-pointed, but not long-awned.*

1. **E. arenarius,** Linn. Culms 3 to 8 feet high, glaucous: leaves strict, acuminate, pungent, 6 lines broad, uppermost very short; sheaths auriculate at throat; ligule very brief: spike 6 to 12 inches long, dense, strict, the rhachis hirsute; spikelets an inch long, closely imbricated, appressed, pubescent, awnless, mostly 3-flowered: glumes acuminate, 3 – 5-nerved: lower palet keeled toward the cuspidate tip, hirsute, ciliate, the upper equalling it. — Reichenb. Icon. Fl. Germ. t. 116; Torr. in Pacif. R. Rep. vi. 92.

Pitt River (*Newberry*); Oregon (*Pickering*); Washington Territory, *Cooper*. Reported as common in the northern parts of the State; not found in the Eastern States, but common in Europe and northern Asia. The spikes are sometimes purplish. The seeds are used as food by the Digger Indians, and as it springs up around deserted lodges is called by the inhabitants "Rancheria-Grass." *E. mollis*, Trin. (not of R. Br.), closely resembles this, and is found far northward and also eastward. It is distinguished by its softer and more downy spikelets, and its much broader 5 – 7-nerved glumes.

2. **E. condensatus,** Presl. Culms from 2 to 6 feet high or more, with ample mostly flat leaves, smooth except on the margins, and as well as the sheaths mostly glaucous, auriculate at the junction with the sheath; ligule a short rigid fringe: spike 5 to 15 inches long, dense or interrupted, simple or frequently made up of fascicled short few-flowered branches; spikelets 3 – 6-flowered: glumes subulate-setaceous, shorter than the spikelet: floret mostly membranous; lower palet 5-nerved above, mucronate-pointed or somewhat 3-toothed; upper palet equalling the lower, 2-toothed above. — Rel. Hænk. i. 265; Boland. in Trans. Calif. Agric. Soc. 1864 – 65, 143; Watson, Bot. King Exp. 391.

Var. **triticoides.** Spike mostly simple; spikelets smaller, 2 or 3 or sometimes only 1 at each joint of the rhachis: florets of firmer texture and sometimes awn-pointed or short-awned. — *E. Virginicus*, var. *submuticus*, Hook. Fl. Bor.-Am. ii. 255. *E. triticoides*, Nutt. in Herb. Phil. Acad.; Buckl. in Proc. Phil. Acad. 1862, 99.

Fort Tejon (*Xantus*); San Juan (*Brewer*); Monterey and San Francisco (*Bolander*); Oregon Boundary (*Lyall*); and frequent through Nevada to Colorado. The variety from Mohave River (*Cooper*) and Mono Lake (*Brewer*) northward to Oregon. This is perhaps the most strikingly variable grass upon the coast, and would furnish several species were the characters constant. At one extreme its stems, according to Mr. Bolander, are 12 feet high, and its roots do good service in retaining the soil of the banks of streams. In these luxuriant forms the culm is as large as the little finger, and the leaves, an inch or more broad, are over 2 feet long. The spike is sometimes an inch and a half thick, dense and continuous, with erect appressed branches 2 inches long, or it is much lobed or sometimes interrupted, with the branches in separate clusters. In most of these large forms the florets are pale straw-color and membranaceous, though in some they are greenish and coriaceous, in which respect they approach the variety *triticoides;* indeed no strict line can be drawn to separate them, and the variety is proposed for those forms that are liable to be taken for some large *Triticum*. When it violates the character of the genus so far as to have but one spikelet at a joint, there is nothing to distinguish the specimens from *Triticum*, though none have been noticed in which there were not somewhere upon the spike two spikelets to the joint. These triticoid forms sometimes branch, and Nuttall collected on Wapatoo Island a subpaniculate form, with branches naked below.

* * *Glumes acuminate-pointed or awned: lower palet with an awn longer than itself.*

3. **E. Sibiricus,** Linn. Culms 2 to 3 feet high: leaves mostly ample, often 6 lines broad, and with the sheaths glabrous throughout or scabrous on the upper surface: spike virgate, 2 to 8 inches long, often somewhat nodding above; spikelets

in pairs, 3 – several-flowered : glumes linear-lanceolate, 3 – 5-nerved, pointed or short-awned : lower palet 5-nerved and rough above, with an awn about once and a half its own length. — *E. glaucus*, Buckl. in Proc. Phil. Acad. 1862, 99.

San Francisco, Ukiah, and elsewhere (*Bolander*) ; Oregon (*Howell, Hall* and others) ; eastward to Lake Superior. Presents a great variety in size of foliage and spike ; the spike generally more or less curved and soft to the touch, sometimes strict and rough.

4. **E. Canadensis**, Linn. Culms stout, 3 to 4 feet high, and with flat rather rough sometimes glaucous leaves : spike 6 to 9 inches long, nodding above, rather loose ; spikelets mostly in pairs, 3 – 5-flowered : glumes subulate, about a line wide at base, 3- or unequally 4-nerved, tapering into an awn somewhat shorter than itself : lower palet rough-hairy, with a longer awn, which is usually spreading.

Oregon (*Pickering, Howell*), eastward to New England ; also New Mexico and Texas. A showy species, especially its glaucous form, var. *glaucifolius*, which is cultivated for ornament.

* * * *Glumes very long, usually 2-parted to the base, the divisions unequally 2-cleft and long-awned : lower palet long-awned and 2-toothed, or 3-awned.* — SITANION. (*Sitanion*, Raf.)

5. **E. Sitanion**, Schult. Culms densely tufted, from 4 inches to 2 feet high : leaves and sheaths varying from smooth and glaucous to roughly hirsute ; leaves mostly flat, setaceously pungent at apex, the upper one an inch or two long, its sheath loose or often inflated and including the base of the spike, which is 1 to 6 inches long and soon breaking into joints ; spikelets mostly in pairs, 1 – 5-flowered : glumes sometimes entire, mostly 2-parted to the base, the divisions unequally 2-cleft and terminating in awns 1 to 3 inches long : lower palet 3 lines long, scabrous and 5-nerved above, its central awn equalling those of the glumes, its lateral nerves often excurrent as short awns or mere teeth. — Roem. & Schult. Mant. ii. 426 ; Watson, Bot. King Exp. 391 ; Thurber in Bot. Wilkes Exped. 495. *Sitanion elymoides*, Raf. ; Torr. Pacif. R. Rep. iv. 157. *Ægilops Hystrix*, Nutt. Gen. i. 86. *Polyantherix Hystrix*, Nees ; Hook. & Arn. Bot. Beechey, 404.

Common from Oregon to San Diego, eastward to Northern Minnesota, and southward to Texas and Mexico. The spikes are usually pale green and shining, but sometimes they are reddish ; indeed each locality seems to present a form differing in stature and smoothness, in the size and color of the spikes, or in the structure of the spikelets. When the glumes are much subdivided and the divisions are straight, stiff and spreading, or when they are capillary and confusingly intertwisted, the plant appears very unlike an *Elymus*. On the other hand, the forms in which the glumes are entire present nothing to distinguish them from the genus to which Mr. Watson properly restored it. In a specimen collected in California by Mr. Fitch the glumes are in part subdivided yet again and the elongated and interrupted spike gives it a very different appearance from any others. In the plant from the Rocky Mountains and eastward the tendency is to have more simple and even entire glumes. Several years ago a very full set of the forms was sent to the late General Munro, concerning which that eminent agrostologist wrote : "A valuable series, showing how many species, and even genera, might be made out of this one."

62. GYMNOSTICHUM, Schreb. BOTTLE-BRUSH GRASS.

Inflorescence in a usually very loose spike, the spikelets 2 or 3 or solitary at each joint of the rhachis, spreading horizontally or somewhat appressed. Spikelets 1 – 4-flowered on a very short callus-like pedicel (when solitary placed flatwise on the rhachis). Glumes none, or represented by awn-like rudiments which are deciduous. Lower palet awned at the tip, otherwise as in *Elymus*.

A genus separated from *Elymus* on account of wanting the glumes. There is one species in the older States, one in New Zealand, and California adds a third.

1. **G. Californicum**, Bolander. Culm stout, 4 to 6 feet high, with ample scabrous leaves, ½ to 1 inch wide ; sheaths, at least the lower, with short stiff spreading hairs : spike 6 to 10 inches long, flexuous, interrupted below, dense above ; spikelets mostly in pairs at the joints, 1 – 3-flowered, on very brief callus-like pedicels,

no trace of glume being present, appressed, at least when young: lower palet 6 lines long, broadly lanceolate, 5-nerved above, the nerves, especially the marginal ones, ciliate-hispid with short stiff rather distant white hairs; awn stout, rough, straight and one-half longer than the palet; upper palet equalling the lower, ciliate above. — Catalogue, 35, without description.

Red Woods, near San Francisco (*Bolander*); Saucelito, *Kellogg & Harford*, n. 1107. Bolander's specimens are very young, being just in flower. In this state they have precisely the aspect of an *Elymus*, resembling greatly some of the tall forms of *E. condensatus*, and entirely without the "bottle-brush" appearance so striking and characteristic in the eastern *G. Hystrix*. The absence of glumes is much more complete than in that species, which often has rudimentary ones. In this the scales to the ovary are very large and beautifully fringed.

Series II. CRYPTOGAMOUS or FLOWERLESS PLANTS.

Plants never bearing true flowers, that is, having no stamens nor pistils, and producing instead of seeds minute homogeneous bodies, called spores, in which there is nothing of the nature of an embryo.

Class III. ACROGENOUS PLANTS or ACROGENS.

Cryptogamous plants with a distinct axis or stem, growing from the apex, and with usually no subsequent increase in diameter, and furnished for the most part with distinct leaves; reproduction by means of antheridia and archegonia, sometimes also by gemmation.

Subclass I. VASCULAR ACROGENS. (By Prof. Daniel C. Eaton.)

Stems containing both woody and vascular tissue. Antheridia or archegonia, or both, formed on a prothallus which is developed from the spore on germination, and upon which the conspicuous but non-sexual plant is produced.

Division I. ISOSPOROUS VASCULAR ACROGENS.

Plant producing but one kind of spore; antheridia and archegonia both produced on a prothallus.

Order CXX. EQUISETACEÆ.

Rush-like, often branching plants, with jointed and almost always hollow stems rising from subterranean rootstocks, the sterile leaves represented by a toothed sheath at the joints, and the fertile ones forming a short spike at the end of the stem or branches.

There is but one genus.

1. EQUISETUM, Linn. Horse-Tail. Scouring-Rush.

Perennial plants with extensively creeping rootstocks. Stems simple or branched, furrowed longitudinally and many-jointed, provided with a central cavity, as well as with cavities opposite the furrows and an intermediate series of minute hollows opposite the ridges. The joints have closed ends, and are crowned with a toothed

sheath, each tooth representing a leaf. The leaves of the fruiting cone or spike (in several close horizontally divergent whorls) are peltate, 5 – 7-angled, and bear several hood-like sporangia on the inner side. Spores round, furnished with two slender filaments attached by the middle and clavate at the free ends, coiling and uncoiling hygroscopically. Prothallus above-ground, green, often variously lobed, usually diœcious.

A genus of about 25 species, some with unbranched stems, others with many branches and branchlets, which are verticillately arranged just below the sheaths of the joints. The ridges of the stem are called *carinæ*, the furrows *valleculæ*, and the hollows beneath them are accordingly carinal or vallecular. The surface of the stem bears minute siliceous appendages in the form of granules, tubercles, rosettes, etc. The furrows are provided with stomata which have inner guard-cells of soft tissue, and outer siliceous cells marked with radiating lines. — For a full account of the structure see Sach's Text-Book and Milde's elaborate Monographia Equisetorum in Nov. Act. Acad. Cæs. Leop. xxxii, part ii, 1865.

* *Stems of two kinds; the sterile with many slender spreading verticillate branches; the fertile usually unbranched, pale, appearing in early spring and soon withering.*

1. **E. arvense**, Linn. Sterile stems rather slender, green and herbaceous, 1 to 2 feet high, 6 – 19-furrowed; branches verticillate, very numerous, mostly simple, four-sided, minutely roughened, the lowest joint commonly longer than the sheath of the stem; fertile stems rarely a foot high, light-brown, the loose scarious sheaths mostly distant, whitish, ending in about 12 brown acuminate teeth: spike rarely over an inch long. — Al. Braun, Am. Journ. Sci. xlvi. 83; Milde, Monogr. 218, t. 1 – 3. *E. boreale*, Bongard, Veg. Sitch. 174, fide Milde.

Sierra Nevada; head of King's River, 7,000 feet elevation (*Brewer*); Clark's Ranch (*Torrey*); Plumas County, *Mrs. R. M. Austin*. Common eastward to the Atlantic, and northward to Alaska and Greenland; also in Europe and northern Asia. There are many variations from the type: sometimes the branches are again regularly branched, and sometimes a fruiting stem will remain through the summer and develop copious branches like those of the sterile stems.

2. **E. Telmateia**, Ehrh. Stems stout, often thick as one's finger; the sterile ones ivory-white or greenish, 2 to 6 feet high, 20 – 40-furrowed, the ridges smooth; branches verticillate, very numerous, erect-spreading, simple, 4 – 5-sided, the ridges rough and deeply sulcate, the lowest joint shorter than the sheath of the stem; fertile stems also white, many-furrowed, the loose brownish sheaths very long, often longer than the internodes: spike 1 to 3 inches long. — Milde, l. c. 240, t. 4 – 6. *E. fluviatile*, Smith. *E. eburneum*, Schreb.; Al. Braun, l. c. 84.

Near San Francisco (*Hartweg*, n. 2038); San Luis Obispo (*Brewer*); Santa Barbara (*Wood*); "Redwoods and mountains near Oakland," *Bigelow*. Oregon and British Columbia, Europe, western Asia, northern Africa, Madeira, etc. Attributed to the shores of the Great American Lakes in various text-books, but probably only through an erroneous label, as pointed out by Dr. Torrey in the Botany of the Mexican Boundary. The verticillately branched stems sometimes produce a fully-developed terminal spike of fructification, constituting the var. *serotinum* of Al. Braun.

* * *Stems all alike, evergreen, unbranched, or producing a few slender cylindrical erect branches: fruit produced in summer. Central cavity of the stems very large.*

3. **E. robustum**, Al. Braun. Stems tall and stout (sometimes as much as 11 feet high and nearly an inch thick), 20 – 48-furrowed; ridges roughened with a single series of transversely oblong siliceous tubercles: sheaths short, cylindrical, appressed, marked with black girdles at the base, and at the base of the caducous teeth; ridges of the sheaths tricarinate. — Am. Journ. Sci. xlvi. 88; Milde, l. c. 532, t. 31.

Not rare, especially in the southern half of the State, the whole range of the species extending from British America to Ohio, Louisiana and Mexico, and perhaps to New Jersey. Also said to

have been collected in Asia. Professor Brewer notes that the stems often throw out small branches from the joints the second year.

4. **E. hiemale,** Linn. Stems 1 to 4 feet high, green, rough, 8 – 34-furrowed; ridges with two indistinct lines of tubercles: sheaths rather long, cylindrical, appressed, marked with one or two black girdles; the ridges of the sheaths obscurely 4-carinate; teeth membranaceous, fuscous, soon deciduous. — Al. Braun, l. c. 89; Milde, l. c. 511, t. 29, 30.

Attributed to San Francisco in Milde's monograph. Common in British America and the Atlantic States, and widely distributed in many varieties throughout Europe and Asia. Not easily distinguished from small forms of the last. Under the microscope the section of the stem shows rounder vallecular hollows, and some other slight differences.

5. **E. lævigatum,** Al. Braun, l. c. 87. Stems 1 to 5 feet high, seldom thicker than a goose-quill, pale-green, 14 – 30-furrowed; the ridges almost smooth: sheaths long, sensibly enlarged upwards, marked with a black girdle at the base of the mostly deciduous fuscous white-margined teeth, and rarely at the base of the sheath also; ridges of the sheath with a single central carina, and sometimes with faint and short lateral ones. — Milde, l. c. 546, t. 32.

Silver Mountain, by streams, at about 6,400 feet elevation (*Brewer*), and collected somewhere in California by *Coulter;* Oregon to Ohio and Louisiana. Readily known by the pale smooth stems and ampliated sheaths. It bears slender branches more frequently than other species of the group.

Order CXXI. OPHIOGLOSSACEÆ.

Leafy plants; the leaves (*fronds*) simple or branched, often fern-like, erect in vernation, developed from underground buds formed from one to three years in advance either within the base of the stalk of the old frond or by the side of it, bearing in special spikes or panicles subcoriaceous exannulate bivalvular sporangia formed from the main tissue of the fruiting segments of the frond. Prothallus under-ground, destitute of chlorophyll, monœcious.

An order consisting of three genera, the two here described and *Helminthostachys* of the East Indies, and including about twenty species in all. *Ophioglossaceæ* are now separated from *Filices* because of differences in the prothalline condition, and because the sporangia are formed from the main tissue of the frond, and not from the surface hairs, or trichomes, as in true ferns. The erect vernation also distinguishes them. Their true position is yet undecided.

1. BOTRYCHIUM, Swartz. Grape-Fern. Moonwort.

Fronds with a posterior pinnatifid or compound sterile segment and an anterior panicled fertile segment, the separate sporangia in a double row on the branches of the panicle. Bud enclosed in the base of the stalk. Veins free.

Ten species are now recognized, of which seven are found in North America.

1. **B. simplex,** Hitchcock. Plant smooth, fleshy, not over 6 inches high: sterile segment petioled, usually set near the base of the plant, varying from simple and roundish-obovate in small plants to triangular-ovate and deeply lobed, or even fully ternate with incised divisions in the most developed forms; lobes broadly obovate-cuneate or slightly lunate, the outer margin obscurely crenulate, sometimes incised; veins flabellately forking; fertile segment once or twice pinnate. — Am. Journ. Sci. vi. 103, t. 8; Davenport, Notes on *B. simplex,* with plate; Eaton, Ferns of N. Amer. i. 121, t. 17; Williamson, Fern Etchings, t. 60, A.

Var. **compositum,** Milde. A low alpine form with the sterile segment an inch long or less, ternate, or composed of three ovate incised segments.

Foot of Lyell Glacier, at 10,200 feet altitude (*John Muir*), and in other elevated places in the Sierra Nevada (*Miss Pelton* and *Dr. Gray*); also in Yellowstone Park. The species extends eastward to the Atlantic, and is known from northern Europe.

2. **B. ternatum,** Swartz. Plant fleshy, sometimes sparsely hairy, usually 4 to 12 inches high: sterile segment long stalked from near the base of the plant, broadly deltoid, ternate, variously decompound; divisions mostly petioled, the ultimate ones usually sessile, roundish reniform to obliquely ovate or ovate-lanceolate, crenulate or toothed or incised; fertile segment twice to four times pinnate, mostly taller than the sterile: bud pilose. — Eaton, l. c. 147, t. 20, 20ª.

Var. **australe,** Eaton, l. c., is the typical form, with usually ample fronds; the sterile segment decompound, tertiary or quaternary divisions ovate-oblong, subacute, pinnatifid; ultimate segments broadly ovate or roundish-rhomboid, the margin crenulate or denticulate. — *B. australe,* R. Brown, Prodr. 164. *B. silaifolium,* Presl, Rel. Hænk. i. 76.

Mountain pastures, Plumas County (*Mrs. Ames* and *Mrs. Austin*), and elsewhere in the Sierra Nevada, *Miss Pelton,* etc. In Oregon, and widely extended through almost all parts of the world. The California specimens are among the largest and finest ever seen.

B. VIRGINIANUM, Swartz (Williamson, l. c., t. 64), with the sterile segment highly decompound, delicate in texture, and sessile high up on the common stalk, is common in the Atlantic States, and has been collected in Oregon and Washington Territory. It is therefore to be sought in the northern counties of California.

2. OPHIOGLOSSUM, Linn. ADDER'S-TONGUE.

Fronds with a posterior simple or forked or palmated sterile segment, having reticulated veins, and one or more anterior or lateral simple spikes of fructification; the connate sporangia in a row along each side of the spike. Fronds from buds at the base of the stalk, but exterior to it.

A genus of about a dozen species, two tropical ones with dichotomous or palmated sterile segments, and the remainder with simple sterile segments, variable in form and venation, and their distinctions not yet sufficiently understood.

1. **O. vulgatum,** Linn. Rootstock slender, erect: fronds mostly solitary, 2 to 12 inches high; sterile segment fleshy, sessile near the middle of the plant, ovate or elliptical, 1 to 3 inches long; midrib indistinct or none, the veins forming large areoles enclosing smaller ones and a few free veinlets: fertile spike an inch long or more, mucronate, commonly long-stalked and overtopping the sterile segment. — Gray, Manual, 672, t. 19; Williamson, Fern Etchings, t. 65, A.

In pastures and meadows, and on grassy hillsides; Arizona and Unalaska, probably in California and Oregon, but not yet reported. It is found in most parts of the world.

ORDER CXXII. FILICES.

Leafy plants; the leaves (*fronds*) often much branched, circinate in vernation, rising from a rootstock, and bearing on the under surface or on the margins reticulated sporangia, which are homologous with leaf-hairs. Prothallus above ground, green, monœcious. — The sporangia are usually collected in little masses called fruit-dots or *sori,* and are often covered by a little scale (*indusium*), which is produced from the cuticle of the frond, or by a general involucre formed from the recurved margin of the frond.

A large order, containing about 80 genera and near 3,000 species, the greater part of which are found in tropical or subtropical regions. Many species are cultivated for ornament, a few are reputed to have medicinal qualities, and a very few have been used as food. Ferns are divided into six suborders, chiefly distinguished by differences in the jointed ring of the sporangia, which is nearly obsolete in *Osmundaceæ,* horizontal and apical in *Schizæaceæ,* transverse and medial in *Gleicheniaceæ,* where also the sporangia are definite in number, transverse in the filmy-fronded *Hymenophyllaceæ,* and oblique but complete in the arboreous *Cyatheaceæ. Marattiaceæ* are now considered a separate order. The remaining suborder, the only one represented in California, is the following.

Suborder I. POLYPODIACEÆ.

Sporangia globular, or slightly flattened laterally, collected in patches, lines or dots of various shapes, stalked, and provided with a vertical incomplete many-jointed ring, which straightens at maturity and discharges the very minute spores.

Tribe I. POLYPODIEÆ. Sori round or oblong, placed on the veins or at the ends of the veins, destitute of indusium. Stalk articulated to a slightly prominent knob of the usually elongated creeping rootstock. Veins free or variously reticulated.

1. **Polypodium.** (Character of the tribe, of which it is the only genus.)

Tribe II. GRAMMITIDEÆ. Sori more or less elongated, without indusium, placed on the back of the frond or its divisions, and usually following the veins, or only at the tips of the latter and near the margin of the frond. Fronds often scaly or tomentose, or covered beneath with colored powder.

2. **Gymnogramme.** Sori much elongated, following the veins, and like them often branched or reticulated.
3. **Notholæna.** Sori but little elongated, often of very few sporangia, placed below the tips of the veins near the margin of the lobes of the frond.

Tribe III. PTERIDEÆ. Sori close to the margin of the frond or its divisions, sometimes extending down the veins, covered, at least when young, by an involucre opening inward and either consisting of the margin or produced from it.

4. **Cheilanthes.** Sori minute, at the ends of the unconnected veins, covered by a usually interrupted involucre. — Small ferns, often woolly, chaffy or pulverulent.
5. **Pellæa.** Sori near the ends of the veins, often confluent. Involucre membranaceous, continuous round the pinnules. Sterile and fertile fronds much alike and smooth; the stalk dark-colored.
6. **Cryptogramme.** Sori extending down the free veins. Involucre very broad, at length flattened out and exposing the now confluent sori. Sterile and fertile fronds unlike, smooth; the stalk light-colored.
7. **Pteris.** Sporangia borne on a continuous vein-like marginal receptacle, which connects the ends of the veins. Involucre continuous round the pinnules. Stalk light-colored.
8. **Adiantum.** Sporangia borne at the ends of the veins, on the under side of the reflexed margin of the frond. Midvein of the pinnules mostly eccentric or dissipated into forking veinlets. Stalk dark-colored.

Tribe IV. BLECHNEÆ. Sori more or less elongated, borne on a fruiting veinlet or a special receptacle parallel to the midrib, either near it or remote from it, and provided with a special usually concave or arched indusium attached to the receptacle outside the sorus and opening along the inner edge.

9. **Lomaria.** Sori continuous from the base of the pinna to its apex, the receptacle nearer the margin than the midvein. Fronds in our species once pinnate, the fertile ones with contracted pinnæ.
10. **Woodwardia.** Sori interrupted, forming a chain-like row each side of the midvein. Fronds in our species ample, compound; the veins reticulated.

Tribe V. ASPLENIEÆ. Sori more or less elongated, borne on veins oblique to the midvein, covered by a special usually flattened indusium attached to the fertile veinlet by one edge and free on the other.

11. **Asplenium.** Sori on the upper side of the fertile veinlet, less commonly on both sides of it. Veins free in our species.

Tribe VI. ASPIDIEÆ. Sori round or roundish, on the back or sometimes at the tip of the fertile veinlets, naked or provided with a special indusium. Stalk not articulated to the rootstock, the tropical genus *Oleandra* excepted.

12. **Phegopteris.** Sori dot-like, minute, borne on the back of the fruiting veinlets; indusium none.
13. **Aspidium.** Sori round, borne on the back or at the apex of the veinlets; indusium orbicular or else round-reniform. Mostly large ferns.
14. **Cystopteris.** Indusium convex, delicate, fixed across the back of the veinlet by a broad base, usually turned back by the ripening sporangia. Delicate ferns with small fronds.
15. **Woodsia.** Indusium placed beneath the sorus, and partly or wholly enclosing it, divided into irregular lobes or into a delicate fringe. Fronds small.

1. POLYPODIUM, Linn. Polypody.

Sori round or oval, very rarely elongated, placed on the back of the frond at the ends of the veins, rarely on the back of the veins, but in many (foreign) species at the point where several veins unite, entirely destitute of indusium. Stalks articulated to a slightly prominent knob of the chaffy rootstock, which is usually creeping and elongated. Veins free or reticulated in several different ways. Fronds smooth and simply pinnatifid in the Californian species.

A genus of about 350 species, of which the greater part inhabit tropical regions. The fronds vary from simple to quadri-pinnatifid, and are sometimes hairy or scaly, or densely stellate-pubescent.

§ 1. *Veins uniformly free.* — Eupolypodium.

1. **P. vulgare**, Linn. Plant 4 to 12 inches high: stalks slender: frond subcoriaceous, evergreen, ovate-oblong to oblong-linear, acuminate, pinnatifid almost to the midrib; segments numerous, linear-oblong, obtuse or acute, crenulate or serrate; veins usually with 3 or 4 veinlets, the lowest ones on the upper side of the vein bearing at their thickened ends the subglobose sori midway between the midrib and the margin of the segments. — Gray, Manual, 658, t. 15; Williamson, Fern Etchings, t. 1; Eaton, Ferns of N. Amer. i. 237, t. 31, fig. 1 – 3.

Near San Francisco and Benicia, and northward, often growing on trees; in the Rocky Mountains and eastward to the Atlantic; also in Europe, Asia and parts of Africa. The plant of the Pacific Coast has long-pointed segments, serrated towards the apex, and is var. *occidentale* of Hooker. But similar forms occur in Europe and even in the Atlantic States.

2. **P. falcatum**, Kellogg. Stalks slender: frond thin-membranaceous, 9 to 15 inches long, 4 to 6 broad, broadly lanceolate in outline, pinnatifid to the midrib; segments numerous, tapering from a dilated base to a very long and attenuate point, often somewhat falcate, sharply serrate, the lower ones a little shorter than those in the middle, and separated by much broader sinuses; veins mostly with four veinlets: sori medium-sized, nearer the midvein than the margin. — Proc. Calif. Acad. i. 20; Eaton, Ferns of N. Amer. i. 201, t. 26. *P. Glycyrrhiza*, Eaton, Am. Journ. Sci. 2 ser. xxii. 138.

On the mossy walls of a mountain cañon, 3,000 feet elevation, Trinity County, *Prof. G. R. Kleeberger*, Oct. 1879. On trees and sometimes on rocks, not rare in Oregon and in Washington Territory. Thinner in texture than *P. vulgare*, to which it is referred by Baker. A careful comparison of living plants is needed before a satisfactory conclusion can be reached.

§ 2. *Veinlets more or less frequently anastomosing by the junction of the second superior veinlet of one group with the first inferior veinlet of the next superior group.* — Goniophlebium.

3. **P. Californicum**, Kaulfuss. Stalks moderately slender: fronds from a few inches to a foot long, papery-herbaceous or, if grown near the sea, subcoriaceous, ovate or ovate-oblong, pinnatifid almost to the midrib; segments numerous, oblong-linear, acute or obtuse, the lower ones mostly opposite, narrowed at the lower side of the base, and separated by rounded sinuses, the upper ones often opposite, dilated at the base, especially on the upper side, and separated by narrow sinuses; margins obscurely or plainly serrate, rarely even incised; veins with four to six veinlets, and often forming a single series of oblique areolations which extend nearly to the margin: sori somewhat oval, rather remote from the margin. — Enum. Fil. 102; Eaton, l. c. 243, t. 31, fig. 4, 5. *P. intermedium*, Hook. & Arn. Bot. Beechey, 405.

California; mostly near the coast, from San Diego and Guadalupe Island northward. Plants grown very near the sea have thicker fronds and veinlets more regularly anastomosing than those which are remote from the influence of the salt water, and correspond more closely with the character given by Kaulfuss, while the inland form is that described by Hooker & Arnott as *P. intermedium*.

4. **P. Scouleri,** Hook. & Grev. Rootstock heavier and stalk stouter than in the other species: frond coriaceous, fleshy, a few inches to a foot long, broadly ovate in outline, pinnatifid to the midrib; segments linear-oblong, obtuse, obscurely serrulate, cartilaginous-margined, the terminal one distinct and often largest of all; veinlets regularly anastomosing, and forming a single series of large areoles with a few external free veinlets: sori very large, one within each areole on the upper segments of the frond, sometimes also on the tips of the other segments. — Ic. Fil. t. 56; Eaton, Ferns of N. Amer. i. 193, t. 26. *P. pachyphyllum,* Eaton, Am. Journ. Sci. 2 ser. xxii. 138. *P. carnosum,* Kellogg, Proc. Calif. Acad. ii. 88, fig. 24.

On trees and stumps, more rarely on rocks or on the ground, near Crescent City and Mount Shasta (*Brewer*); Marin County (*Miss Pelton*), and Guadalupe Island (*Palmer*); Oregon and northward to British Columbia. This very fine Polypody was first described from specimens only a few inches high, but it is now known to be the largest of our Pacific Coast species.

2. GYMNOGRAMME, Desv.

Sori oblong or linear, following the course of the veinlets and, like them, either simple, forked, pinnated or variously anastomosing, without indusium.

A large and not very natural genus, the species with fronds mostly rather small and of very diverse shapes, many with one or both surfaces hairy, tomentose, or covered with white or yellow waxy powder. Only two species are known to occur in the United States.

1 **G. triangularis,** Kaulfuss. (California Gold-Fern.) Stalks densely tufted, slender, blackish-brown, polished, a few inches to a foot long: fronds deltoid or pentagonal, 2 to 5 inches long and nearly as broad, pinnate; the lower pair of pinnæ much the largest, triangular, broadest on the lower side, bipinnatifid; the rest oblong or lanceolate, more or less pinnately lobed or incised; segments rounded-obtuse, crenated; lower surface coated with a yellow or white waxy powder, upper surface smooth or minutely granular: lines of fruit forking, bursting through the colored powder, and at length nearly obscuring it. — Enum. Fil. 63; Hooker, Fil. Exot. t. 10.

Var. **viscosa,** Eaton. Frond ovate-pyramidal; pinnæ rather distant; upper surface viscid, as if varnished; powder of the lower surface creamy white. — Ferns of N. Amer. i. 16, t. 48, fig. 5.

Common on rocky hillsides throughout California, extending northward, it is said, to Vancouver Island, and reappearing in Ecuador. The variety is found in the southern part of the State, though specimens differing from the common plant only in the white powder occur sparingly as far north as Butte County.

3. NOTHOLÆNA, R. Brown.

Sori on the veins at or near their extremities, roundish or oblong, soon more or less confluent into a narrow marginal band, with no proper involucre, but sometimes covered at first by the reflexed margin of the frond. Veins always free. Fronds of small size, 1 to 4 times pinnate, the lower surface almost always either hairy, tomentose, chaffy or covered with waxy powder.

A genus of less than forty species, most abundant in dry, rocky places from New Mexico to Chili, but a few are found in the Mediterranean region, in South Africa, Australia, etc., and one occurs as far north as Kansas and Missouri. Mettenius referred many of them to *Gymnogramme* and the rest to *Cheilanthes,* with both of which genera this has very close affinities.

* *Fronds woolly or tomentose, especially on the lower surface.*

1. **N. Newberryi,** Eaton. Rootstock creeping, covered with very narrow dark-brown subulate scales: stalks clustered, 3 to 6 inches long, slender, blackish-brown, at first woolly: fronds as long as the stalks, lanceolate-oblong, covered, most densely beneath, with a web of very fine entangled whitish hairs, 3 to 4 times pinnate; pinnæ triangular-ovate, the lowest ones rather distant, but scarcely smaller; ultimate segments crowded, roundish-obovate, one third to one half a line wide, en-

tire or slightly crenate: sporangia rather large, blackish, at length emergent from the tomentum. — Torr. Bot. Bulletin, iv. 12, and Ferns of N. Amer. i. 301, t. 39, fig. 11 – 14.

In dry rocky places in the southern part of the State, and on Guadalupe Island. First collected in San Diego County by *Prof. Newberry.* The tomentum is exceedingly fine; though at first nearly pure white, it gradually becomes more or less ferruginous, while the covering of the stalks wears off, leaving them smooth and faintly shining.

2. **N. Parryi,** Eaton. Rootstock short, inclined, laden with narrow rather rigid scales, which are fulvous and often have a blackish midnerve: stalks 2 to 5 inches high, dark-brown or blackish, minutely striated, pubescent with spreading jointed whitish hairs: fronds as long as the stalks, oblong-lanceolate, tripinnate; lower pinnæ distant; ultimate segments crowded, roundish-ovate, about one line long, crenately incised, densely covered above with entangled white hairs, and beneath with a still heavier pale-brown tomentum: sporangia blackish, when ripe projecting beyond the margin of the segments. — Amer. Naturalist, ix. 351, and Ferns of N. Amer. ii. 209, t. 74.

Crevices of dry rocks, Marengo Pass, San Bernardino County (*Dr. Parry*), and on the eastern slope of San Jacinto Mountain, *Mr. Wm. Stout.* Originally found near St. George, Utah, and since seen also in the mountains of Arizona. It is a smaller fern than the last, and has larger ultimate segments and much coarser tomentum. It more resembles *Cheilanthes lanuginosa,* Nutt., but has no involucre, and the pubescence is coarser and more entangled.

** *Frond beneath waxy-pulverulent.* — (*Cincinalis,* Desv.)

3. **N. candida,** Hooker. Rootstock creeping, the scales narrow, rigid and nearly black: stalks tufted, 3 to 6 inches long, wiry, black and shining: fronds shorter than the stalks, deltoid-ovate, pinnate; pinnæ lanceolate from a broad base, deeply pinnatifid, the lowest pair having the inferior basal segments much elongated and again pinnatifid, the other pairs gradually decreasing to the apex of the frond; segments oblong, slightly curved, obtuse, minutely glandular above, beneath covered with white or yellow waxy powder, except on the blackish midribs; margins slightly revolute, but not covering the intramarginal line of dark-brown sporangia. — Sp. Fil. ii. 116, and v. 110; Eaton, Ferns of N. Amer. ii. 21, t. 49, fig. 1 – 3. *N. pulverulenta,* Kunze, in Linnæa, xiii. 135. *N. sulphurea,* J. Smith, Bot. Voy. Herald, 233; Hooker & Baker, Syn. Fil. 373.

In crevices of sunny rocks; Spring Valley, San Diego County (*Miss A. L. Barbeck*), and in several other places in the same county, *Cleveland, Parry, Wm. Stout.* The California specimens are all rather small, and the color of the waxy powder is pale yellow. Larger fronds, with white powder, have been gathered in Western Texas, New Mexico and Arizona, and the range extends southward to Chili, the powder being of all shades from silvery white to orange-yellow.

4. CHEILANTHES, Swartz. Lip-Fern.

Sporangia borne on the thickened ends of free veinlets, forming small and roundish distinct or somewhat confluent marginal sori, covered by a whitish and membranaceous, or sometimes unchanged and herbaceous, common involucre, formed of the reflexed margin of separate lobes or of the whole segment. — Small ferns, with 2 to 4 times pinnate fronds, the under surface either smooth or variously covered with hair, wool, scales or waxy powder.

A genus of over sixty species, of which about eighteen are found in the United States. It differs from *Notholæna* only in the presence of a marginal involucre, which is sometimes so continuous as to render the separation of the species from *Pellæa* very difficult.

§ 1. *Involucres separate, one to each fertile veinlet.* — Adiantopsis, Hooker & Baker. (*Adiantopsis,* Fée.)

1. **C. Californica,** Mettenius. Stalks densely tufted, dark-brown, glossy, 4 to 8 inches long: fronds 2 to 4 inches long, smooth and green on both surfaces, broadly

deltoid-ovate, delicately quadripinnatifid; the upper portion of the main rhachis and all its divisions with a narrow herbaceous border; lower pinnæ much the largest, triangular-ovate, more developed on the lower side; upper pinnæ gradually smaller and simpler; ultimate pinnules lanceolate, very acute, incised or serrate; when fruiting, with mostly separate crescent-shaped membranaceous involucres in the sinuses between the teeth, which are often at length recurved. — Cheilanthes, 44; Eaton, Ferns of N. Amer. i. 45, t. 6, fig. 2. *Hypolepis Californica*, Hooker, Sp. Fil. ii. 71, t. 88, A.

In moist ravines and shady cañons, not rare in the Coast Ranges of the southern counties, and also sent from near Santa Cruz by *Bolander*, and from Sonoma County by *W. A. T. Stratton*, who finds it covering an immense rock of sandstone on Dry Creek, a branch of Russian River; Sonora, Mexico, *Schott*. This is a very delicate little fern, with evident relationship to *C. Schimperi*, and having very little in common with the genus *Hypolepis*, in which it is placed by British writers.

§ 2. *Involucres more or less confluent, usually extending over the apices of several veinlets, but scarcely continuous all round the segment: segments not bead-like.* — Eucheilanthes, Hooker & Baker.

2. **C. viscida**, Davenport. Stalks tufted, 3 to 5 inches high, wiry, dark-brown or blackish and shining, chaffy at the base with narrow bright-ferruginous crisped scales: fronds herbaceous, minutely glandular and everywhere viscid, 3 to 5 inches long, narrowly oblong in outline, pinnate with 4 to 8 rather distant pairs of nearly sessile deltoid bipinnatifid pinnæ 5 to 8 lines long and nearly as broad; segments toothed, the minute herbaceous teeth recurved and each covering from 1 to 3 sporangia. — Torr. Bot. Bulletin, vi. 191; Eaton, Ferns of the Southwest, 311, and Ferns of N. Amer. i. 85, t. 12, fig. 1.

Downieville Buttes and on bluffs at the White Water River in the Colorado Desert (*Lemmon*), and near San Gorgonio Pass, *Parry, Lemmon*. The obvious affinity of this species is with *C. Wrightii*, from which the viscid and more dissected fronds and the herbaceous involucre abundantly distinguish it.

3. **C. Cooperæ**, Eaton. Stalks densely tufted, 1 to 4 inches long, dark-brown, fragile, hairy like the frond with entangled or straightish nearly white articulated often gland-tipped hairs: fronds 3 to 8 inches long, ovate or ovate-lanceolate, bipinnate, the rather distant pinnæ oblong-ovate; pinnules roundish-ovate, crenate or crenately incised, the ends of the lobules reflexed and forming herbaceous involucres; segments at first slightly concave, becoming flat at maturity. — Torr. Bot. Bulletin, vi. 33, and Ferns of N. Amer. i. 7, t. 2, fig. 1.

Clefts of rocks in cañons and on the sides of mountains; near Santa Barbara (*Mrs. Elwood Cooper, Mrs. Stanley Bagg*); Santa Clara County (*H. G. Isaman*); Downieville Buttes (*Lemmon*); near San Bernardino, *Lemmon, Parry, W. G. Wright*. Related to the eastern *C. vestita*, but in that fern the hairs are always acute, and the frond has a narrower outline. The drawing above cited does not give a good idea of the plant.

§ 3. *Ultimate segments minute, bead-like; involucre usually continuous all round the margin: fronds 2–4-pinnate, the lower surface tomentose or scaly, the covering at first white, often becoming tawny as the fronds mature.* — Physapteris, Presl. (*Myriopteris*, Fée.)

* *Ultimate segments tomentose beneath, but not scaly.*

4. **C. gracillima**, Eaton. Rootstocks creeping and assurgent, forming a dense entangled mass, chaffy with narrow rigid dark-brown appressed scales: stalks slender, dark-brown: fronds 1 to 4 inches long, linear-oblong, bipinnate or sometimes partly tripinnate; primary and secondary rhachises bearing delicate narrow bright-brown scales, as do the stalks when young; pinnæ many pairs, crowded, 3 to 6 lines long; ultimate pinnules crowded, oblong-oval, $\frac{3}{4}$ to 1 line long, at first webby above, soon smooth, beneath heavily covered with ferruginous matted wool; involucres yellowish-brown, formed of the continuously recurved margin. — Bot. Mex.

Bound. 234, and Ferns of the Southwest, 313. *C. vestita*, Brackenridge, Ferns of U. S. Expl. Exped., not of Swartz.

In rocky places, mostly at high elevations (6,000 to 8,000 feet), from the Yosemite to Oregon, by many collectors; also in British Columbia. Called "Lace Fern" by visitors to the Yosemite. A single specimen from Bartlett's Cañon, near Santa Barbara, collected by *Rothrock*, is twice the usual size, and fully tripinnate.

* * *Fronds very scaly beneath, and sometimes sparingly tomentose also.* (*The species of this group are very perplexing, all much resembling each other and difficult to define. The most distinctive characters are found in the rhizoma or rootstock.*)

5. **C. myriophylla**, Desv. Rootstock short, ascending, often nodose, covered with narrow dark-brown rigid scales: stalks clustered, 2 to 6 inches high, wiry, castaneous, covered with partly deciduous pale-cinereous narrow appressed scales and paleaceous hairs: fronds 3 to 8 inches long, ovate-oblong or oblong-lanceolate, smooth and green or deciduously pilose above, 3–4-pinnate; rhachises and midribs densely covered beneath with pale-brown or ferruginous ovate or ovate-lanceolate ciliated scales; pinnæ deltoid-ovate, narrower upwards; ultimate segments minute (half a line broad), roundish or roundish-pyriform, crowded, innumerable, sometimes (especially those of sterile fronds) three-lobed or parted, covered beneath with ovate scales having few or many long tortuous cilia passing into branched and entangled hairs, the unchanged margin of the segments much incurved. — *C. elegans* and *C. myriophylla*, Desvaux in Berlin Mag. v. 328; Hooker, Sp. Fil. ii. 100 and 102, t. 105. *C. myriophylla*, Hooker & Baker, Syn. Fil. 140; Eaton, Ferns of the Southwest, 316. *C. elegans*, Kuhn, Beitr. 8. *C. paleacea*, Martens & Galeotti, Syn. Fil. Mex. 76, t. 21, fig. 2.

In crevices of rocks and on exposed rocks, mostly at elevations of 3,000 to 5,000 feet, from Lake County southward in the Coast Ranges, and in the Sierra Nevada from Western Nevada to San Bernardino County; South Pass of the Rocky Mountains, Arizona and New Mexico, and to Peru and Chili. This fern presents many forms, some with broad and but slightly ciliated scales often passing for *C. Fendleri*, or recommended as probably distinct species by various authors and collectors. I have seen no genuine *C. Fendleri* from California, the plants formerly so called being all forms of the present species.

6. **C. Clevelandii**, Eaton. Rootstock cord-like, creeping, elongated, covered with narrow rigid dark-brown scales: stalks scattered, 2 to 6 inches long, dark-brown, at first bearing paleaceous hairs: fronds 4 to 6 inches long, ovate-lanceolate, 3–4-pinnate, smooth and green above, beneath everywhere deep fulvous-brown (when mature) from the dense covering of closely imbricated ovate-acuminate elegantly ciliate scales; ultimate segments crowded, innumerable, flattish, nearly round, sessile, $\frac{1}{3}$ to $\frac{1}{2}$ a line broad, the terminal ones a little larger; margins narrowly recurved and unchanged in texture. — Torr. Bot. Bulletin, vi. 33, and Ferns of N. Amer. i. 89, t. 12, fig. 2.

In loose sandy soil and at the base of rocks, among the mountains of San Diego County (*D. Cleveland, W. Stout*); also in the Peninsula of Lower California, *A. Schott*. The rootstock is nearly as thick as a goose-quill and several inches long. The scales are at first white, but gradually turn to a rich chestnut-brown. Specimens recently received confirm the species.

5. PELLÆA, Link. Cliff-Brake.

Sori roundish or oblong, placed near the ends of the veins, often confluent in a submarginal band: involucre membranaceous, often broad, continuous round the pinnules, and formed from their reflexed margin. Sterile and fertile fronds much alike, 1–4-pinnate, generally smooth and sometimes glaucescent. Stalk usually dark-colored.

A genus of about 50 species, none of them large ferns. Eleven species occur in the United States, a few more in tropical America, and a good many in South Africa. The genus is closely

allied to *Cheilanthes*, from which it differs in the continuous involucre, and in never having tomentose or scaly fronds.

§ 1. *Fronds herbaceous or subcoriaceous; veins clearly visible; involucre broad, and usually covering the sporangia till they are fully ripe.* — CHEILOPLECTON, Hooker & Baker.

1. **P. Breweri,** Eaton. Plant 4 to 8 inches high: rootstock short, stout, very chaffy with narrow fulvous scales: stalks crowded, terete, fragile, bright-brown, chaffy only at the base: fronds as long as the stalks, oblong, pinnate; pinnæ six to twelve pairs, short-stalked, membranaceous, 6 to 9 lines long, mostly two-parted, the upper lobe largest; lobes and simple upper pinnæ ovate or triangular-ovate, cuneate and often subcordate at the base; veins twice or thrice forked; involucre delicate. — Proc. Amer. Acad. vi. 555, Bot. King Exp. 395, t. 40, fig. 17, and Ferns of N. Amer. i. 331, t. 43.

Clefts of exposed rocks in the higher cañons of the Sierra Nevada, thence eastward to the Wahsatch; also in Colorado near the Rio Grande. Thinner in the texture of the frond than any of the following, and related to *P. gracilis* of the East, and to the Mexican *P. Seemanni.* The stalks are excessively fragile.

§ 2. *Fronds coriaceous or subcoriaceous; veins not evident; involucre conspicuous.* — ALLOSORUS, Hooker & Baker.

* *Pinnules obtuse or emarginate.*

2. **P. andromedæfolia,** Fée. Rootstock slender, creeping, chaffy with narrow rusty scales: stalks scattered, erect, terete, smooth, brownish or reddish, chaffy at the base, variable in length: fronds 4 to 24 inches long, ovate or ovate-oblong, 2–4-pinnate; primary pinnæ spreading, oftenest opposite, ovate-lanceolate; ultimate pinnules glaucescent, subsessile, 2 to 4 lines long, broadly oval, slightly cordate and emarginate, fertile ones with the edges rolled back to the midvein: involucre herbaceous with a narrow whitish edge. — Gen. Fil. 129; Hooker, Sp. Fil. ii. 149; Eaton, Ferns of N. Amer. i. 203, t. 27, fig. 1. *Allosorus andromedæfolius,* Kaulf. in Kunze, Analect. Pteridogr. 18, t. 11.

Rocks and hillsides, mostly in the Coast Ranges; also in Chili. Plants with blood-red fronds occur in the southern counties (var. *rubens,* Eaton in Torr. Bot. Bulletin, vi. 360). The color is now believed to be occasioned by direct sunlight.

* *Pinnules acute or mucronate.*

† *Fronds bipinnate only.*

3. **P. Wrightiana,** Hooker. Rootstock short, thick, nodose, densely chaffy with narrow appressed dark-brown scales: stalks clustered, dark-purplish, polished, very rigid, 4 to 10 inches long: fronds 4 to 10 inches long, lanceolate or triangular-lanceolate in outline, bipinnate, pinnæ subsessile, spreading; pinnules coriaceous, smooth, beneath glaucescent, at most about six pairs, crowded or remote; those of the sterile fronds roundish-oval, 3 to 5 lines long, two thirds as broad, rounded and even subcordate at the base, the apex obtuse, but with a minute cartilaginous subulate point; those of the fertile fronds rolled back to the midvein, often longer than the sterile ones and curved upwards, similarly mucronate. — Sp. Fil. ii. 142, t. 115, B; Eaton, Ferns of N. Amer. ii. 5, t. 47, fig. 1–3. Also *P. longimucronata,* Hooker, l. c. 143, t. 115 A. *P. mucronata,* Eaton in Bot. Mex. Bound. 233, in part.

Growing in heavy compact masses from under a rock on Mount San Bernardino, at 7,000 feet altitude (*W. G. Wright, Lemmon*); Arizona, New Mexico, and Bolivia (*P. Weddelliana,* Fée). The rootstocks are compacted in great masses, and though the resemblance to bipinnate forms of *P. Ornithopus* is considerable, it seems best to keep the two ferns apart.

4. **P. brachyptera,** Baker. Rootstock short, knotted, chaffy with narrow rusty denticulate scales: stalks 6 to 8 inches long, erect, wiry, blackish and shining: fronds nearly as long as the stalks, rigid, narrowly oblong-linear in outline, bipin-

nate; pinnæ several pairs, sessile, ascending or appressed to the rhachis, very short, often broader than long; pinnules 5 to 13 to a pinna, 3 to 6 lines long, crowded, oblong-linear, greenish-glaucescent, mucronulate, the edges much rolled back, making the pinnules nearly terete, and covering the sori. — Syn. Fil. 2 ed. 477; Eaton, Ferns of N. Amer. ii. 9, t. 47, fig. 4–6. *Platyloma brachypterum*, T. Moore, in Gard. Chronicle, 1873, 141. *Pellæa Ornithopus*, var. *brachyptera*, Eaton, in Torr. Bot. Bulletin, iv. 16, and Ferns of the Southwest, 322.

Rocky places in the Sierra Nevada (*Bolander, Mrs. Ames, Mrs. Austin, Kellogg & Harford*); Lassen's Peak (*Lemmon*); Weaverville, *Kleeberger*. In moist situations the growth is much larger than in dry places. *Platyloma bellum*, Moore, is probably a form of this species, but is not known to me. The common plant so named is *P. Ornithopus*, modified by cultivation.

\+ + *Fronds tripinnate when fully developed.*

5. **P. Ornithopus**, Hooker. Rootstock short, thick, knotted, densely chaffy with very narrow dark-brown scales: stalks clustered, rather stout and very rigid, dark-purplish or almost black, polished, 2 to 10 inches long: fronds 4 to 12 inches long, rigid, broadly ovate-lanceolate, tripinnate or in smaller plants bipinnate; primary pinnæ spreading or obliquely ascending, linear, bearing from a few up to 16 pairs of usually trifoliolate, but varying to simple or to 5–7-foliolate, nearly sessile pinnules, which are commonly 1½ to 3 lines long, coriaceous, mucronulate, glaucescent beneath, roundish-quadrate in the very rare sterile fronds, and in the fertile fronds having the margins rolled back to the midvein. — Sp. Fil. ii. 143, t. 116, A; Eaton, Ferns of the Southwest, 322, and Ferns of N. Amer. ii. 11, t. 47, fig. 7–10. *Allosorus andromedæfolius*, Hooker, Pl. Hartweg. 342, not of Kaulfuss. *A. mucronatus*, Eaton, in Am. Journ. Sci. 2 ser. xxii. 138. *P. mucronata*, Eaton, Bot. Mex. Bound. 233, in part.

Dry exposed rocks, very common from Mendocino County to San Diego; also on Guadalupe Island, *Palmer*. The trifoliolate pinnules bear considerable resemblance to the three claws of a bird's foot, whence the specific name. Small forms with bipinnate fronds have passed for *P. Wrightiana*, but do not form the massive rootstocks of the latter, and are said by Mr. Wright to cease their yearly growth long before it.

6. **P. densa**, Hooker. Rootstocks rather slender, branching and entangled, chaffy with narrow blackish scales: stalks densely tufted, slender, wiry, dark-brown, dull or polished, 3 to 9 inches long: fronds ovate or deltoid-ovate, 1½ to 2½ inches long, closely tripinnate; segments 3 to 6 lines long, nearly sessile, lance-linear, acute or mucronate, in the rare sterile fronds sharply serrated, in the fertile fronds entire, the margins narrowly recurved and bearing a paler distinct involucre. — Sp. Fil. ii. 150, t. 125, B; Eaton, Ferns of N. Amer. i. 77, t. 11, fig. 1. *Onychium densum*, Brackenridge, Fil. of U. S. Expl. Exped. 120, t. 13, fig. 2; Torrey, Pacif. R. Rep. iv. 160.

Clefts of rocks, not rare at elevations of 6,000 to 8,000 feet in the Sierra Nevada, from the Castle Mountains to the Yosemite; also in Oregon and in Wyoming Territory. The indusium is a very delicate special organ, growing just within the margin of the segments.

§ 3. *Texture coriaceous, usually concealing the veins; ultimate segments broad and flat, the involucre narrow and at length hidden by the confluent sporangia.* — PLATYLOMA, Hooker & Baker. (*Platyloma*, J. Smith.)

7. **P. Bridgesii**, Hooker. Rootstock short, creeping, densely chaffy with narrow castaneous scales: stalks 3 to 6 inches long, clustered, terete, wiry, dark reddish-brown, smooth and shining: fronds as long as the stalks, linear-oblong, simply pinnate; pinnæ 5 to 18 pairs, mostly opposite, subsessile, glaucous green, coriaceous; sterile ones orbicular or subcordate, 4 to 5 lines long, rarely larger; fertile ones somewhat narrow, often at first conduplicate and apparently lunate: involucre narrow, formed of the whitish cartilaginous margin of the pinnæ, soon flattened out and exposing the sori confluent in a broad intramarginal band. — Sp. Fil. ii. 238, and iii, t. 142, B; Eaton, Ferns of N. Amer. i. 327, t. 43, fig. 1–4.

Clefts of rocks in the Sierra Nevada, mostly at from 6,000 to 9,000 feet elevation. The under surface of the frond sometimes bears a trace of the same yellowish waxy powder seen in many species of *Gymnogramme* and *Notholæna*.

P. FLEXUOSA, with flexuous rhachis and rather large cordate-ovate pinnules occurs in Arizona, and may yet be discovered in the southern part of California. *P. gracilis* and *P. atropurpurea* are well-known species of the Eastern States.

6. CRYPTOGRAMME, R. Brown. ROCK-BRAKE.

Sporangia on the back or near the ends of the free veins, forming oblong or roundish, and at length confluent sori: involucres continuous, formed of the membranaceous and somewhat altered margins of the pinnules, at first reflexed and meeting at the midrib, at length opening out flat. Fronds rather small, herbaceous, smooth, dimorphous, 2–4-pinnate, the fertile ones taller than the sterile, and with narrowly elliptical or oblong-linear pod-like segments. Stalks stramineous, tufted on a short rootstock.

A genus of only two species, *C. crispa* of Europe, and the following.

1. **C. acrostichoides,** R. Brown. Rootstocks short, creeping, chaffy: stalks densely clustered: fronds chartaceous, ovate, 2–3-pinnate, 2 to 4 inches long; sterile ones short-stalked, having narrowly winged rhachises, ultimate segments crowded, ovate or obovate, adnate-decurrent, crenately toothed or slightly incised; fertile fronds long-stalked, the rhachises scarcely winged, ultimate segments oblong or linear-oblong, 3 to 5 lines long, scarcely one line wide; involucres very broad: sori oblong, extending down the forked veinlets almost to the midvein. — Hooker & Greville, Ic. Fil. i, t. 29; Eaton, Ferns of N. Amer. ii. 99, t. 59, fig. 1–5; Williamson, Fern Etchings, t. 7. *Allosorus acrostichoides,* Sprengel; Gray, Manual.

Common among rocks at high elevations, extending to Colorado, Lake Superior, the Aleutian Islands and Arctic America. The fronds are more rigid and less compound than in *C. crispa,* and the sporangia are not limited to the upper part of the veins, as they are in that species. But several able botanists consider the two as forming but one species.

7. PTERIS, Linn. BRACKEN.

Sporangia seated on a continuous vein-like marginal receptacle, which connects the ends of the veins: involucre extending around the margins of the segments, or sometimes interrupted at their apices, and sometimes double. Fronds, in the only Californian species, ample and decompound, the veins free.

A large genus, having many tropical species, with fronds varying from simple to decompound, the veins free or variously reticulated. Stalks commonly light-colored.

1. **P. aquilina,** Linn. Rootstock blackish, cord-like, creeping widely underground: stalks solitary, erect, naked, swollen and discolored at the base: frond sometimes 3 feet long and nearly as broad, rigidly subcoriaceous, smooth or pubescent, triangular-ovate in outline, 2–4-pinnate at the base; principal primary pinnæ stalked, the lowest ones very large, the rest rapidly becoming smaller; pinnules oblong-lanceolate or linear, entire, hastate, or pinnately parted; segments oblong or linear, obtuse, the terminal ones often elongated; veins close-placed, free, repeatedly forking. — Eaton, Ferns of N. Amer. i. 263, t. 35; Williamson, Fern Etchings, t. 10.

Var. **lanuginosa,** Bong. Lower surface of the frond decidedly pubescent or silky-tomentose, the segments broad. — Veg. Sitch. 176.

Very common throughout the State, extending northward to Sitka and eastward to Utah. In Northern California and Oregon it forms thickets six or seven feet high and several acres in extent. The plant of the Eastern States is less pubescent or nearly smooth. The bracken is the most widely distributed of all ferns, and in many parts of the world either the young fronds, when boiled, or the rootstocks after roasting, have served as articles of food. The mature fronds have been used for thatching, and the ashes for scouring or for making domestic soap.

8. ADIANTUM, Linn. Maidenhair.

Sporangia borne at the ends of the veinlets, on the under (inner) side of the reflexed margin of the frond, the involucre thus formed being either continuous or interrupted or divided into small and widely separated lobules. Midvein of the ultimate pinnules mostly excentric or lateral, or the forking and usually free veinlets rising directly from the end of the petiolule of the segments. Stalk mostly blackened or very dark purplish-brown, and commonly highly polished.

Sixty-seven species are described by Keyserling, in his excellent monograph on this genus, published in Mém. Acad. Sci. St. Pétersb. viime série, tome xxii, No. 2. A few tropical species have simple roundish fronds, others are simply pinnate, and the remainder are variously 2–4-pinnate or decompound, but never dissected into narrow segments.

* *Fronds pyramidal in outline, 2–4-pinnate at the base; main rhachis continuous to the apical pinnule: veins dichotomous, the veinlets extending to the ends of the teeth of the segments.*

1. **A. Capillus-Veneris**, Linn. (Venus-Hair.) Plant 4 to 24 inches high, often pendent: stalks and rhachises very slender, nearly black, polished: fronds elongated-pyramidal, thin, smooth, simply pinnate towards the apex, 2–3-pinnate below; pinnules and upper pinnæ rather long-stalked, 6 to 15 lines long, rhomboid or roundish-obovate, cuneate at the base, somewhat palmately lobed or incised; the ends of the lobes crenately or acutely denticulate except where the margin is recurved to form the lunulate or transversely oblong separated involucres. — Hooker, British Ferns, t. 41; Eaton, Ferns of N. Amer. i. 281, t. 37.

Damp and shady places in the cañons of the southern part of the State (*G. W. Dunn, Mrs. Cooper, Mrs. Bagg, Dr. Rothrock*), and eastward to Utah, Texas, Missouri, and the Atlantic States from Virginia to Florida. Also in Europe, Asia, Africa, South America, etc.; a well-known plant, formerly used in preparing "Sirop de Capillaire," a popular cough-remedy.

2. **A. emarginatum**, Hooker. Plant a few inches to two feet high, usually erect: stalks rather stouter than in the last, nearly black, polished, about half the whole height of the plant: fronds broadly ovate or deltoid-pyramidal, simply pinnate towards the apex, 2–3-pinnate below; pinnæ obliquely spreading, lower ones half as long as the frond; pinnules long-stalked, 4 to 15 lines broad, roundish or semicircular or even reniform, the lower sides entire, the outer edge rounded, slightly 2–5-lobed, finely and sharply toothed in the sterile fronds, but in the fertile recurved and forming pale transversely elongated involucres. — Sp. Fil. ii, t. 75, A; Keyserling, l. c. 15, 37; Eaton, Ferns of the Southwest, 325, and Ferns of N. Amer. i. 285, t. 38, fig. 1–3. *A. Chilense* of American authors, not of Kaulfuss. *A. Æthiopicum*, in part, Baker, Syn. Fil. 123.

Among rocks in cañons, both dry and moist, common in the Coast Ranges from San Diego to Oregon, but scarcely known in the Sierra Nevada. Keyserling has well distinguished this species from the others related to it. Hooker's figure, although said to be taken from a Mauritius plant, well represents only our species, and was probably drawn from a Californian specimen. A pubescent *Adiantum* (*A. dilatatum*, Nutt. MS. in Herb. Hook.), reported from near Monterey by Nuttall, has not been collected since his time: it may have been *A. tricholepis*, Fée (Eaton, Ferns of the Southwest, 326), or a hairy form of the present species, or something different from both.

* * *Fronds rounded-fan-shaped in outline, the stalk forking at the top, the forks recurved and each bearing several pinnate branches on the upper side.*

3. **A. pedatum**, Linn. Stalks dark-brown or blackish, polished, a foot or more high, forked at the top, the two branches divaricate and obliquely recurved, bearing on their upper or outer sides 6 to 14 long spreading pinnate divisions: pinnules numerous, short-stalked, thin, smooth, oblong or triangular-oblong, the lower margin entire and often hollowed out, the base parallel with the polished hair-like rhachis, the upper margin lobed or cleft and bearing a few oblong-lunate or transversely

linear reflexed involucres: principal vein of each pinnule closely parallel to its lower margin, the veinlets forking. — Eaton, Ferns of N. Amer. i. 135, t. 18; Williamson, Fern Etchings, t. 11. *Adiantum Americanum*, Cornutus, Canad. Pl. Hist. 7, t. 6.

Common among the Coast Ranges, also on Mount San Bernardino (*W. G. Wright*), and in the Yosemite, *Lemmon*. The range includes nearly all the United States, British America and northeastern Asia to the Himalayas. Pacific Coast specimens have the pinnules more deeply lobed than those from the Eastern States. A few South American and Australasian species have the fronds similarly divided, and from them, as well as from young plants of this species, it is evident that one of the two middle divisions is really the proper continuation of the central axis. Cornutus's name, though much the oldest, is ante-Linnæan, and therefore has never been adopted.

9. LOMARIA, Willdenow.

Sporangia in a continuous band, seated on a special receptacle each side of the midrib of the fertile pinnæ, and covered till mature by an elongated involucre either formed of the recurved and altered margin or (in our species and some others) separate and closely parallel to the margin. Fronds dimorphous, usually pinnatifid or once pinnate; the sterile with broader foliaceous pinnæ and usually free veins; the fertile with very narrow pinnæ, and the veins often forming a single series of areoles each side of the midrib.

A genus of about forty-five species, the greater part tropical or recurring in the south temperate zone, some of them with large and showy evergreen fronds. It is closely connected with *Blechnum*, which has the fertile fronds but slightly contracted, and the involucre remote from the margin.

1. **L. Spicant,** Desvaux. (Deer-Fern.) Rootstock short and thick, very chaffy: fronds tufted, erect, smooth; sterile ones nearly sessile or on short stalks, subcoriaceous, narrowly linear-lanceolate, 6 to 30 inches long, 1 to 3 inches wide, tapering from above the middle to both ends, pinnatifid to the rhachis into very numerous closely placed oblong or oblong-linear often upwardly falcate obtuse or apiculate segments, the lower ones diminished to minute auricles; fertile fronds taller and more erect than the sterile, long-stalked, pinnate; pinnæ less crowded, longer and much narrower than the sterile segments, sessile by a suddenly dilated base; involucres just within the margin: mature sporangia nearly covering the back of the pinnæ. — Berlin Mag. v. (1811) 325; Brackenridge, Ferns of U. S. Expl. Exped. 123; Eaton, Ferns of N. Amer. i. 249, t. 32, fig. 3–5. *Blechnum boreale*, Swartz; Hooker, Brit. Ferns, t. 40.

On the ground in dense forests, sometimes in open places, from Santa Cruz County (*Anderson*) to Oregon and northward; also in Europe, the Caucasus, Kamtschatka and Japan. Some of the Pacific Coast specimens are exactly like the European, but plants growing in rich and shaded localities are very large and tall, forming var. *elongata* of Hooker's Species Filicum. *Blechnum doodioides*, Hook. Fl. Bor.-Am. ii. 263, and Sp. Fil. iii. 60, t. 153, is founded on a couple of fronds from British Columbia, in which the lower half is sterile and the upper half fertile, with the fruit broken into short sori, and the outer margin of the pinnules wider than usual.

10. WOODWARDIA, Smith. Chain-Fern.

Sori oblong or linear, interrupted, occupying paracostal areoles and forming a chain-like row each side of the midribs and midveins. Indusium convex, fixed by its outer margin to the fertile veinlet, free and opening on the inner side. Fronds various; the veins forming oblong areoles next the midribs, and outside of these either anastomosing or free.

Besides the following species there are two in the Eastern States, and two or three more in eastern Asia.

1. **W. radicans,** Smith. Rootstock stout, chaffy with abundant ferruginous-brown scales: fronds long-stalked, standing in a circle, often 4 to 6 feet high, or

even higher, subcoriaceous, oblong-ovate, pinnate; pinnæ 4 to 15 inches long, broadly lanceolate, pinnatifid nearly to the midrib; segments lanceolate from a broad base, slightly falcate, acuminate, spinulose-serrate and sometimes more or less pinnatifid; veinlets forming a single row of oblong often sorus-bearing areoles each side the midvein, besides a few empty oblique areoles outside of these; outer veinlets free extending to the teeth of the margin: sori oblong-linear, a few sometimes formed also along the midribs of the pinnæ. — Mém. Acad. Turin, v. 412; Hooker & Arnott, Bot. Beechey, 162 and 405; Eaton, Ferns of N. Amer. ii. 117, t. 61. *Woodwardia Chamissoi*, Brackenridge, Ferns of U. S. Expl. Exped. 138.

Along living streams, especially in forests, from Mendocino County to San Diego, less common in the Sierra Nevada than in the Coast Ranges. Mexico, Guatemala and Peru; also from the Canaries to Abyssinia, India and Java. The Old World plant often produces a large scaly bud near the apex of the frond, which takes root and produces a new plant. This bud has not been found in America, but its absence is all there is to separate our plant from the other.

11. ASPLENIUM, Linn. Spleenwort.

Sori oblong or linear, oblique to the midvein, borne on the upper side of the fertile veinlets, sometimes on the lower side also, covered by a special indusium attached to the fertile veinlet by one side and free on the other. Veins free in our species.

A very large genus, containing over 300 species, the fronds varying from simple to highly decompound. Eighteen species are known to occur in the United States.

§ 1. *Sori straight, nearly always confined to the upper side of the veins, which are uniformly free.* — Euasplenium.

1. **A. Trichomanes**, Linn. Stalks densely clustered, 1 to 5 inches long, nearly black, polished and very narrowly herbaceous-margined, as is the rhachis, which persists after the pinnæ have fallen: fronds 2 to 8 inches long, narrowly linear, rather rigid, evergreen, pinnate; pinnæ numerous, nearly sessile, roundish-oval or oval-oblong from an obtusely cuneate or truncate base, entire or crenulate-toothed; midvein nearly central; veins few, oblique, usually once forked: sori oblong, 3 to 6 or more each side of the midvein; indusia very delicate, entire or obscurely crenulate. — Hooker, Brit. Ferns, t. 29; Eaton, Ferns of N. Amer. i. 271, t. 36, fig. 1 – 3; Williamson, Fern Etchings, t. 20.

Var. **incisum**, Moore. Pinnæ rather larger, incisely lobed, the lobes often crenated or serrate. — Nat. Pr. Brit. Ferns, t. 39, D, E; Eaton, l. c.

The type is a common fern throughout the north temperate zone, becoming larger in the tropics, and there receiving several distinctive specific names. It has been found in California only once, by *Gen. A. B. Eaton*, in crevices of rocks on Monte Diablo, in 1855. Var. *incisum* was found near San Diego by *Dr. Newberry* in 1857, and has since been collected in the same part of the State by *Cleveland*, *Stout*, and others.

§ 2. *Sori and indusia often curved, the latter sometimes crossing the fertile veinlet and continued some little way down on the lower side also, thus becoming horse-shoe-shaped: fronds mostly 2 – 4-pinnate.* — Athyrium.

2. **A. Filix-fœmina**, Bernhardi. (Lady-Fern.) Stalks a few inches to a foot long, discolored and chaffy at the base: fronds standing in a vase-like circle, softly membranaceous, 1 to 3 feet long, oblong-lanceolate, acuminate, more or less narrowed at the base, 2 – 3-pinnate: primary pinnæ numerous, short-stalked, oblong-lanceolate from a broad base, acuminate; pinnules adnate to the narrowly winged secondary rhachis, ovate-oblong and doubly serrate, or elongated and pinnately incised with cut-toothed segments; veins forked or pinnated, the lowest superior veinlet of each group commonly soriferous: sori near the midveins; indusium short, usually lacerate-ciliate on the free edge. — Schrader's Neues Journ. Bot. 1806, ii. 26, 48, t. 2, fig. 7; Hooker, British Ferns, t. 35; Eaton, Ferns of N. Amer. ii. 225, t. 76; Williamson, Fern Etchings, t. 27.

Damp, rich woods, not rare. A common fern throughout temperate North America, Europe and northern Asia, presenting very many modifications in size, shape of the frond, and cutting of the pinnæ and pinnules. The fully developed subtripinnate form (var. *commune*, Eaton) is not rare in California. Var. *latifolium*, Hook., with broadly ovate-oblong pinnules, var. *cyclosorum*, Ruprecht, with very large and broad fronds and roundish sori, and var. *angustum*, with narrow and rather rigid fronds, besides various intermediate forms, are all found within the State.

12. PHEGOPTERIS, Fée.

Sori roundish, minute, naked, placed on the back of the veins below their attenuated apices. Fronds various, subtripinnate in our only species. Stalk continuous with the rootstock, and not joining it by an articulation as in *Polypodium*.

This genus, containing about 100 species, differs from *Aspidium* only in having no indusium. Four species are found in North America, three of them also common to Europe.

1. **P. alpestris**, Mettenius. Rootstock short and thick, erect or assurgent: stalks subterminal, 4 to 10 inches long, chaffy near the base: fronds 1 to 2 feet long, membranaceous, smooth, oblong-lanceolate, acuminate, pinnate with delicately bipinnatifid deltoid-lanceolate pinnæ, the lower pinnæ distant and decreasing moderately; pinnules ovate-oblong, or ovate-lanceolate, doubly incised and toothed: sori small, round, usually copious on all but the lowest pinnæ. — Fil. Hort. Lips. 83; Eaton, Ferns of N. Amer. i. 171, t. 23, fig. 1. *Polypodium alpestre*, Hoppe; Hooker, Brit. Ferns, t. 6, and Sp. Fil. iv. 251.

Among rocks at high elevations; top of Lassen's Peak, and on Mount Shasta, Pyramid Peak, and other high peaks in the Sierra Nevada, *Brewer*, *Lemmon*, *Muir*, etc. This fern often forms patches of several feet in extent, as noticed repeatedly by *Brewer* and *Lemmon*. It is found also in British Columbia, and in the mountains of northern and central Europe to the Caucasus.

P. POLYPODIOIDES, Fée (Eaton, Ferns of N. Amer. ii. 217, t. 75, fig. 1 – 4). Rootstock very slender, creeping: fronds 4 to 6 inches long, hairy on the veins, deltoid-ovate, bipinnatifid with obtuse lobes: rhachis interruptedly winged by the adnate basal segments of the pinnæ. Said to have been recently discovered near San José. It is a common fern in the Eastern States north of Tennessee, and is found in Alaska, Greenland, Labrador, Europe, northern Asia and Japan.

P. DRYOPTERIS, Fée, with a smooth ternate frond, primary divisions stalked and 1 – 2-pinnate with obtuse lobes, is an eastern and European fern, found in Oregon, but not yet in California.

13. ASPIDIUM, Swartz. SHIELD-FERN. WOOD-FERN.

Sori round, borne on the back or at the apex of the veinlets, the indusia round and attached to the middle of the sorus by a short central stalk, or roundish-reniform and attached at the base of the sinus or indentation. Veins free in the Californian species, the fronds mostly large and once or twice pinnate.

A genus embracing, as here understood, over 300 species, the greater part tropical or subtropical, but a few extending to the Arctic regions. Standard British works divide the genus into two, corresponding with the following sections.

§ 1. *Indusium roundish-reniform or orbicular with a narrow sinus.* — DRYOPTERIS. (*Nephrodium*, Hooker & Baker.)

* *Texture thin or membranaceous: veins simple or once forked.*

1. **A. Nevadense**, Eaton. Rootstock rather stout, creeping, chaffy and covered with persistent stalk-bases: fronds thin and delicate, standing in a crown, short-stalked, narrowly lanceolate, 1½ to 3 feet high, pinnate; pinnæ linear-lanceolate from a broad and nearly sessile base, 2 to 4 inches long, deeply pinnatifid; the lower pairs distant and gradually reduced to mere auricles; segments crowded, narrowly oblong, obtuse, subentire, slightly hairy on the veins beneath and minutely resinous-dotted: veins mostly simple, the lower ones sometimes forked: sori close to the margin; indusium minute, glandular and sparsely pilose. — Ferns of N. Amer. i. 73, t. 10.

Moist and shady places along creeks and in mountain meadows; Butte County (*Mrs. Ames*); Plumas County (*Mrs. Ames* and *Mrs. Austin*); Trinity County (*Kleeberger*); Webber Lake, and

at several places in the Sierra Nevada, *Lemmon*. Also collected several years ago by *F. A. Miller*, the station not known. The fronds of this fern much resemble those of the eastern *A. Noreboracense*, but the rootstock is very different.

2. **A. patens**, Swartz. Rootstock rather stout, creeping, bearing several fronds at the growing end: fronds thin but rather firm, softly pubescent beneath, often long-stalked, 2 to 5 feet high, ovate-oblong, pinnate; pinnæ linear-acuminate, often 4 to 6 inches long, pinnatifid three-fourths of the way to the midrib, the lower ones not reduced; segments very numerous, crowded, obliquely oblong, obtuse or acute, basal ones longest: veins simple, free, or the lowest ones of adjoining segments sometimes uniting and sending out a short veinlet to the nearest sinus: sori near the margin; indusium very pubescent. — Syn. Fil. 49; Hook. & Arn. Bot. Beechey, 405; Eaton, Ferns of N. Amer. ii. 181, t. 70. *Nephrodium patens*, Desv.; Hook. Sp. Fil. iv. 95.

In several cañons near Santa Barbara, *Mrs. Cooper, Rothrock, Lemmon*, etc. Attributed to San Francisco in the Botany of Beechey's Voyage, but not found there of recent years. Texas to Florida, tropical America generally, South Africa and Polynesia.

* * *Texture firmer or subcoriaceous: veins forking freely.*

3. **A. rigidum**, Swartz. Rootstock stout, ascending, very chaffy: fronds 1 to 2 feet long, standing in a crown, borne on moderately long very chaffy stalks, subcoriaceous, nearly evergreen, smooth and green above, paler and glandular beneath, ovate-lanceolate in outline, usually bipinnate; pinnæ oblong-lanceolate, the lowest ones broadest and a trifle shorter than the middle ones; pinnules oblong, incised or doubly serrate, conspicuously veiny: sori large, nearer the midvein than the margin; indusium firm, convex, orbicular with a very narrow sinus, the edge glandular. — Syn. Fil. 53; Milde, Fil. Eur. et Atl. 126.

Var. **argutum**, Eaton. Frond broader in outline, with larger pinnæ and segments, its texture rather heavier and the teeth more decidedly spinulose. — Ferns of the Southwest, 333, and Ferns of N. Amer. ii. 1, t. 46. *A. argutum*, Kaulfuss, Enum. Fil. 242; Torr. Pacif. R. Rep. iv. 160, and vii. 21. *Lastrea arguta*, Brackenridge, Ferns of U. S. Expl. Exp. 196.

Rocky hillsides and copses, commoner in the western counties than in the Sierra Nevada, extending northward to Oregon and southward to the Sierra Madre of Mexico. The Californian plant differs from the common typical European form mainly in the more generous outline of the frond and its subdivisions. It is very fragrant in drying, so that a few fronds will perfume a large bundle of dried plants.

A. SPINULOSUM, Swartz (Eaton, Ferns of N. Amer. ii. 163, t. 68), a common eastern fern, has been found in Oregon. The texture is thinner than in *A. rigidum*, and the pinnæ more finely cut, with more spinulose teeth, etc.

§ 2. *Indusium orbicular and entire, peltate, fixed by the depressed centre or short central stalk to the middle of the sorus: pinnæ and pinnules often auricled on the upper side of the base: veins free.* — POLYSTICHUM.

* *Pinnæ or pinnules serrate with spiny-pointed teeth. Large ferns.*

4. **A. munitum**, Kaulfuss. Rootstock stout, ascending, chaffy: stalks a few inches to a foot long, chaffy, at least at the base, with abundant large glossy-brown acuminate scales: fronds 1 to 4 feet long, standing in a crown, subcoriaceous, evergreen, lanceolate in outline, simply pinnate; pinnæ very many, often chaffy beneath, as is commonly the rhachis, 1 to 4 inches long, linear-acuminate, very sharply and often doubly serrate with incurved aculeate teeth, auricled at the upper side of the nearly sessile base and obliquely truncate at the lower, all or only the upper ones fertile, but not contracted; veins forking: sori abundant, at length confluent. — Enum. 236; Hook. Fl. Bor.-Am. ii. 261; Eaton, Ferns of N. Amer. i. 187, t. 25. *Polystichum munitum*, Presl; Brackenridge, l. c. 203; Eaton, Bot. Mex. Bound. 235.

Var. **nudatum**, Eaton. Frond small, nearly devoid of chaff; pinnæ few, rather remote, oblong-oval, slightly auricled: sori scanty, confined to the ends of a few of the highest pinnæ. — Ferns of N. Amer. i. 188.

Var. **imbricans**, Eaton, l. c. Frond not large, broadest at the base; pinnæ crowded, lanceolate-oblong, pale, ascending and imbricated; stalk scaly at the base only, the rhachis and frond naked: sori submarginal.

Var. **inciso-serratum**, Eaton, l. c. Frond ample; pinnæ lanceolate-acuminate from a conspicuously auricled base, incised with serrated teeth; veins branched into five or six veinlets: sori scattered.

Common throughout the State; the finest specimens from near the coast in the northern counties. Var. *nudatum* was found in Yosemite Valley by *Professor Wood*. Var. *imbricans* in Mendocino and Plumas Counties, etc., and a form connecting it with the first variety was collected in the Trinity Mountains and on the Yuba River. Var. *inciso-serratum* has been sent only from British Columbia. The fern nearest to this one is *A. falcinellum*, Swartz, from Madeira.

5. **A. aculeatum**, Swartz. Rootstock stout, chaffy: stalks of variable length, chaffy like the rhachis with large and small scales intermixed: fronds 1 to 2 feet long, forming a crown, firmly membranaceous, more or less fibrillose-chaffy beneath, evergreen, oblong-lanceolate, normally bipinnate, but often pinnate with deeply pinnatisect pinnæ; pinnæ closely placed, lanceolate from a broad base, often curved upwards; segments varying from rhomboid-oval and confluent on the secondary rhachis to triangular-ovate, distinct and auricled on the upper side of the base, entire or serrate or incised, the lobes and teeth aculeate: sori in two rows on the segments, nearer the midvein than the margin. — Syn. Fil. 53; Hooker, Syn. Fil. iv. 18; Eaton, Ferns of N. Amer. ii. 123, t. 62.

Var. **Californicum**, Eaton, l. c. Frond elongated; pinnæ lance-linear, slightly incised above the middle, more and more deeply cut towards the rhachis; segments rhomboid-ovate, serrate, the lowest superior one largest, but not a distinct pinnule. — *Aspidium Californicum*, Eaton in Proc. Am. Acad. vi. 555.

Var. **lobatum**, Kunze. Smaller: frond lanceolate; pinnæ lanceolate from a broad base, pinnatifid into mostly distinct but sessile pinnules, a few of the lowest often somewhat auricled on the upper side of the base. — *Aspidium aculeatum*, var. *lobatum* and var. *intermedium*, Hooker, Brit. Ferns, t. 10, 11.

Var. **angulare**, Braun. Frond oblong-lanceolate, truly bipinnate; pinnules distinct, short-stalked, mostly auricled and slightly incised, the upper basal one often largest and pinnatifid. — Hooker, Brit. Ferns, t. 12. *Aspidium angulare*, Willdenow.

Var. **scopulinum**, Eaton. Frond short-stalked, narrowly lanceolate, less than a foot long, subcoriaceous, pinnate; pinnæ less than an inch long, ovate, rather obtuse, the lower part pinnately lobed, the upper part serrate with barely aculeate teeth: sori remote from the margin. — Ferns of N. Amer. ii. 125.

Mountainous districts in Santa Cruz and Mendocino Counties, the last variety in the Sierra Nevada and in Idaho. The first and the last varieties are confined to the regions named, but the second and third are common in Europe. Still another form (var. *Braunii*) is found from Lake Superior to northern New England and New Brunswick, and in continental Europe. The species in one or another of its many forms occurs in nearly all parts of the world.

* * *Pinnæ or segments crenated or serrate with pointless teeth. Small ferns.*

6. **A. mohrioides**, Bory. Rootstock short, chaffy: fronds clustered, borne on short chaffy stalks, subcoriaceous, oblong-lanceolate, 4 to 12 inches long, narrowed slightly from the middle to the base, pinnate; pinnæ numerous, 6 to 18 lines long, usually imbricated, ovate or ovate-lanceolate, obtuse, pinnately lobed with crenately toothed segments, or in the largest fronds pinnate with ovate-trapezoid crenated obtuse pinnules: sori on the upper pinnæ; indusia very large and often imbricated. — Bot. Voy. Coquille, 267, t. 55, fig. 1; Eaton, Ferns of N. Amer. ii. 251, t. 80.

On the southern slopes of Mt. Eddy, at the headwaters of the South Fork of the Sacramento River, *Lemmon*. First known from the Falkland Islands, then from Patagonia and the mountains of Chili, then from the Prince Edward Islands, and now from a station six thousand miles distant from the nearest of the others. A plant of very condensed habit, but in its largest forms showing considerable resemblance to the last variety of the preceding.

14. CYSTOPTERIS, Bernhardi.

Sori rather small, round, placed on the back of the free veins, covered when young by a very delicate roundish or ovate convex indusium fixed across the veinlet just below the sporangia, and usually turned back by the latter as they ripen. Delicate ferns with small fronds.

Of the five known species one (*C. bulbifera*) is peculiar to Eastern North America, and two to Europe and Western Asia. The other two occur in both hemispheres.

1. **C. fragilis**, Bernhardi. Rootstock elongated, creeping, chaffy toward the apex: stalks clustered, fragile, a few inches to a foot long: fronds broadly lanceolate, thin-membranaceous, smooth, usually bipinnate; pinnæ oblong-ovate or somewhat deltoid, pointed; pinnules decurrent on the winged secondary rhachis, ovate or ovate-oblong, obtuse, toothed or variously incised with toothed lobules; veinlets mostly extending to the points of the teeth: sori small; indusium roundish, entire or toothed, often hidden by the ripened sporangia. — Torr. Fl. N. York, ii. 501; Williamson, Fern Etchings, t. 46; Eaton, Ferns of N. Amer. ii. 49, t. 53.

Common in rocky places. The range of this fern is from within the Arctic Circle to Chili in the west, and to South Africa and Tasmania in the east.

C. MONTANA, with small deltoid delicately tripinnate fronds and a very slender and creeping rootstock, has been found in the Rocky Mountains of British America, and may possibly occur in the northern part of the Sierra Nevada.

15. WOODSIA, R. Brown.

Sori round, borne on the back of the free veins: indusium very delicate, attached to the receptacle beneath the sporangia and at first partly or wholly enclosing them, divided sometimes almost to the centre into irregular lobes or into a delicate fringe. Small tufted ferns, growing on exposed rocks.

This genus, consisting of a dozen or fifteen species, varies a good deal in the form of the indusium, which is sometimes shaped at first like a bowl and then breaks into irregular segments, or it is composed of several lobes folded together like an old-fashioned wallet, or it is reduced to a minute saucer-like scale beneath the sporangia, having the edge fringed with longer or shorter cilia. Robert Brown's three original species, *W. Ilvensis*, *hyperborea* and *glabella*, all occur in Canada and the Northeastern States, and *W. obtusa*, Torrey, is common from the Atlantic to Arkansas, and perhaps Colorado.

1. **W. scopulina**, Eaton. Plant growing in dense tufts: stalks 2 to 4 inches high, brownish-straminеous, puberulent like the rhachis and the lower surface of the frond with minute jointed hairs and stalked glands: fronds 4 to 8 inches long, oblong-lanceolate, pinnate; pinnæ numerous, 8 to 15 lines long, oblong-ovate, subacute, deeply pinnatifid into 5 to 8 pairs of short ovate or oblong obtuse crenulate or toothed lobes: sori submarginal; indusium very delicate, deeply cleft into narrow segments which terminate in short hairs composed of irregular cylindrical cells. — Canad. Nat. ii. 91, and Ferns of N. Amer. ii. 193, t. 71.

From Mono Pass northward to Oregon and eastward to Colorado. This and the next have not the obscure articulation in the stalk which is seen in the three species named by Robert Brown.

2. **W. Oregana**, Eaton. Habit and stature of the last, but the fronds almost or quite smooth, the sterile ones shorter than the fertile; teeth of the lobes often reflexed and covering the submarginal sori: indusium very minute, divided almost to the centre into a few moniliform hairs. — Canad. Nat. ii. 90, and Ferns of N. Amer. ii. 185, t. 71; Gray's Manual, 5 ed. 669; Williamson, Fern Etchings, t. 51.

In masses around lava-rocks on high plateaus along Pitt River, *Lemmon*. Oregon to Lake Superior, Colorado and Arizona. The glabrous fronds and rudimentary involucre distinguish it from the last.

Order LYCOPODIACEÆ, the Club-Moss or Ground-Pine Family, is characterized by the small leaves, usually lanceolate or subulate, sometimes oblong or roundish, not divided, persistent, placed in 2 to many rows on trailing or sometimes erect usually branching stems, and by the 1 – 3-celled sporangia solitary in the axils of the leaves or on their upper surface, all filled with numerous minute spores, and separating into 2 or 3 valves when mature. Prothallus [in the only known instance] underground and without chlorophyll.

An order of three genera, *Lycopodium*, *Tmesipteris* and *Psilotum*, the latter of very few species, the first numbering about 100, of which 11 are found in North America. The genus Lycopodium, Linn., consists of moss-like plants, with leaves varying from round to slenderly subulate and imbricated in 4 to many rows on the pinnately or dichotomously branching stems, and with reniform 1-celled sporangia opening transversely, situated in the axils of the ordinary leaves, or the fruiting leaves modified into bracts and the fructification forming stalked or sessile spikes. No species is known to have been as yet found in California, but the following may be looked for on the mountains of the northern part of the State. Both have distinct spikes of fructification.

L. annotinum, Linn. Stems creeping; branches upright, dichotomous, 4 to 6 inches high: leaves in several ranks, spreading, lanceolate, pointed, serrulate, 2 to 4 lines long: spikes solitary at the ends of leafy branches. — Washington Territory, northward to Unalaska and eastward to the Atlantic.

L. clavatum, Linn. Stems widely creeping; branches upright, subpinnately branched, 4 to 8 inches high: leaves many-ranked, linear-subulate, spreading, but with the apex incurved and bristle-pointed: spikes 2 to 4 together on a slender terminal peduncle. — Same range as the last.

Tmesipteris Forsteri, Endlicher, an Australasian plant, nearly a foot high, with vertical oblong leaves half an inch long, some of them 2-lobed and bearing in the fork a large 2-celled sporangium, is accredited to California in Bot. Beechey, and there are specimens at Kew marked "California, Douglas"; but there is no recent evidence that it is a Californian plant.

Division II. HETEROSPOROUS VASCULAR ACROGENS.

Plant producing two kinds of spores; the larger ones (*macrospores*) developing a prothallus with archegonia; the smaller ones (*microspores*) producing antherozoids.

Order CXXIII. SELAGINELLEÆ.

Leafy plants, terrestrial or rooted in mud, never of great size; the stems branching or corm-like, and the leaves minute and arranged in four rows or subulate and elongated. Sporangia one-celled, solitary, axillary or borne on the upper surface of the leaf near its base and enwrapped by its margins, some containing macrospores only and others only microspores.

1. SELAGINELLA, Beauvois.

Sporangia axillary, minute, subglobose, opening transversely; some containing usually 4 globose macrospores, others, which are smaller and more abundant, filled with numerous microspores. — Moss-like plants with slender branching stems and small leaves arranged in 4 or several ranks.

The number of species described is over 200, the greater part tropical. Many of them are very elegant, and a few are common in conservatories.

* *Leaves all alike, arranged in many ranks, those of the fruiting spikes 4-ranked, but otherwise like the rest.*

1. **S. rupestris**, Spring. Stems prostrate or ascending, rather rigid, 2 to 12 inches long, vaguely or subpinnately branching: leaves glaucescent, closely imbri-

cated and appressed, lanceolate, scarcely a line long, convex and grooved on the back, bristle-tipped and ciliate: spikes strongly quadrangular; macrosporangia abundant, intermixed with the slightly smaller and more numerous microsporangia. — Gray, Manual, 5 ed. 675, t. 20; Milde, Fil. Eur. et Atl. 260.

On dry rocks, especially in mountainous districts, not rare; found in America, Europe, Asia and Africa. It presents a variety of forms, stout and condensed, long and slender, with the bristly appendage of the leaves longer or shorter, etc. A cross-section of the stem shows a thick layer of firm dark tissue surrounding the vascular axis.

2. **S. Oregana**, Eaton, *n. sp.* Stems pendent, flaccid, 1 to 6 feet long, pinnately much branched: leaves not glaucescent, loosely imbricated, scarcely a line long, linear-lanceolate, convex and grooved on the back, acute but not bristle-tipped, sparsely spinulose-denticulate: spikes very slender; macrosporangia scarce.

Hanging from branches in dense masses, in moist forests; Port Orford, *Lieut.* (now *General*) *A. V. Kautz*, 1855, and in Tilamook Valley, *Mrs. Summers*, 1878. Very much softer than the last, the spikes scarcely distinguishable from the sterile branchlets. The cross-section of the stem is very unlike that of the last species, and shows a much softer and nearly colorless tissue. As it has been found within a few miles of the boundary of the State, there is scarcely a doubt that it will be discovered within its limits.

* * *Leaves in four rows; the lateral rows of larger leaves than the two upper ones, the branches seemingly flattened.*

3. **S. Douglasii**, Spring. Stems decumbent, 6 to 24 inches long, rooting at the base of the branches; branches 4 to 6 inches long, 2–3-pinnately divided: lateral leaves a line long, obliquely oval, obtuse, faintly nerved; upper leaves half as long, oval but incurved and shortly apiculate; both kinds sparingly ciliate at the base: spikes terminal, quadrangular; bracts cordate-acuminate. — *Lycopodium ovalifolium*, Hook. & Grev. Ic. Fil. t. 177, not Desv. *L. Douglasii*, Hook. & Grev.; Hook. Fl. Bor.-Am. ii. 268.

Oregon and Washington Territory, *Douglas*, *Hemphill*, *J. Howell*, etc. Probably in Northern California. This is flat-branched, like most of the species of the genus, and more like some tropical forms than any other of the northern species.

S. LEPIDOPHYLLA, Spring, from Lower California, Arizona, etc., is a nest-like ball when dry, but when moistened expands and shows many pinnately compound branches disposed in a spiral about a closely coiled central stem; the leaves closely imbricated, ovate, obtuse, somewhat scarious-margined, those of the upper rows scarcely smaller than the others. It is often called "Resurrection-plant," and may possibly occur in the southern counties.

S. CALIFORNICA, Spring, was collected by *Deppe* in Lower California, and is not known within the limits of the State. It is a small plant with erect 3 to 4 times dichotomous branches, the leaves in 4 rows; lateral leaves unequally ovate, obtuse, mucronulate, minutely denticulate on the upper margin; leaves of the intermediate rows five times smaller, ovate-oblong, subcordate and entire.

2. ISOETES, Linn. QUILLWORT.

Rush-like aquatic or littoral plants with a short solid corm-like stem, and long subulate cellular leaves, the bases of which are expanded and have thin stipule-like infolded margins (the *velum*) which enclose large simple ovoid thin-walled sporocarps or sporangia; the outer ones containing large spheroid trivittate macrospores, and those of the inner leaves filled with minute obliquely oblong and triangular microspores.

Species very numerous, not less than 15 or 18 being known in the United States. Pending the publication of a new monograph by Dr. Engelmann, the following descriptions are taken from his former writings.

1. **I. Bolanderi**, Engelm. Trunk [stem] deeply 2-lobed: leaves (5 to 20, 2 to 4½ inches long) 4-angled, slender, tapering to a very fine point, bright-green, soft, epidermis-cells elongated, with stomata, but without peripheric bast-bundles; sporocarp mostly oblong, about a quarter or half covered by the velum, unspotted; macro-

spores (0.15 to 0.23 of a line wide) beset with minute points and wrinkles; microspores (.013 to .015 of a line long) more or less papillose or spinulose, deep brown. — Amer. Naturalist, viii. 214.

Ponds and shallow lakes on the Sierra Nevada at 5,000 to 10,000 feet altitude, in several places (*Bolander*); also near Yellowstone Lake, *Parry*.

2. **I. pygmæa,** Engelm. l. c. Deeply submerged, having few (5 to 10) short (½ to 1 inch long) stout rapidly tapering dark-green leaves, with very short often even square epidermis-cells, without stomata or bast-bundles: sporocarp circular with a very narrow velum; macrospores (0.18 to 0.25 of a line wide) marked with smaller and more regular, rarely confluent, rather sharp points; microspores (.012 to .014 of a line long) brown, very minutely papillose or almost smooth.

In large patches in mud covering gravel, deeply submerged in running water, on the Mono trail, eastern declivity of the Sierra Nevada, at 7,000 feet altitude, *Bolander*, 1866. Closely allied to the last species, distinguished by its stout short leaves without stomata, the markings of the larger macrospores, etc.; in many respects near *I. lacustris*.

I. Nuttallii, Al. Braun, a terrestrial species, with triangular leaves 3 to 7 inches long, having numerous stomata, the oblong sporocarp entirely covered by the velum, and the macrospores minutely verrucose, occurs in Oregon and is to be sought for in Northern California.

Order CXXIV. MARSILIACEÆ.

Perennial plants rooted in mud, having a slender creeping rhizome and either filiform or 4-parted long-petioled leaves; the somewhat crustaceous several-celled conceptacles borne on peduncles which rise from the rhizome near the leaf-stalks or are more or less consolidated with the latter, and contain both macrospores and microspores.

The order consists of two genera of similar habit. In both the leaves or leaf-stalks are circinate in vernation. The macrospores have a minute terminal papilla, which produces a small prothallus bearing a few archegonia, fertilized by antherozoids formed within the microspores.

1. MARSILIA, Linn.

Conceptacles or sporocarps ovoid or bean-shaped, composed of two vertical valves having several transverse compartments or sori in each valve; the sori composed of both macrosporangia and microsporangia. The sporocarps are provided with a ring, which is the outer part of the vertical dissepiment, and which at the opening of the valves swells up and becomes a mucilaginous filament, tearing the sori from their places within the valves. — Plants with peltately quadrifoliolate leaves on slender petioles; the sporocarps peduncled and rising either from the petiole or from the rhizome at the base of the petiole.

About 50 species are known, of which 5 or 6 occur in the United States. The plants commonly grow in mud under shallow water and have floating leaves, but are sometimes terrestrial. In many species the sporocarp has two short teeth near its insertion on the peduncle.

1. **M. vestita,** Hook. & Grev. Leaflets broadly cuneate, usually hairy, entire, 2 to 7 lines long and broad; petioles 1 to 4 inches long: peduncles free from the petiole; sporocarps solitary, short-peduncled, about 2 lines long, very hairy when young; upper tooth longest, acute, straight or curved; lower tooth obtuse, the sinus between them rounded. — Ic. Fil. t. 159; Engelm. Amer. Journ. Sci. 2 ser. iii. 55; Al. Braun, in Monatsb. Acad. Berlin, 1863, 423. *M. villosa*, Brackenridge, Ferns of U. S. Expl. Exp. 340, as to the American plant.

Collected in California by *Dr. Pickering*, and in upland soil at Brownsville, Yuba County, *A. Wood;* Oregon to Texas. *M. macrotata*, Al. Braun, is a form of this species with longer peduncles and less hairy sporocarps.

2. PILULARIA, Linn.

Sporocarps globose, longitudinally 2–4-celled, dehiscent from the apex; the cells with parietal placenta-like cushions bearing in the upper portion microsporangia, and below these numerous sporangia containing solitary macrospores. — Plants with a slender creeping rhizome and filiform leaves; the sporocarps subsessile or peduncled on the rhizome in the axils of the leaves.

Five species are known. They grow in the muddy borders of ponds and in occasionally inundated places in America, Europe, Northern Africa and Australia.

1. **P. Americana**, Al. Braun. Leaves setiform, 1 inch long: sporocarps about a line in diameter, attached by the side to a short descending peduncle, usually 3-celled; macrospores in each cell 13 to 17, not constricted in the middle. — Monatsb. Acad. Berlin, 1863, 435, and 1872, 666. *Pilularia*, Nuttall, Fl. Arkans. 140.

Near Santa Barbara (*Mrs. Ellwood Cooper*), May, 1879; Arkansas (*Nuttall*); also in Chili. Less than half as large as the European *P. globulifera*, which has erect and regularly 4-celled sporocarps.

Order CXXV. SALVINIACEÆ.

Floating plants with a more or less elongated and sometimes branching axis bearing apparently distichous leaves: conceptacles very soft and thin-walled, two or more on a common stalk, 1-celled and having a central often branched receptacle which bears either macrosporangia containing solitary macrospores, or microsporangia containing numerous microspores.

The order consists of two genera, *Salvinia*, not represented in the United States, and *Azolla*, having each but very few species. The order is often united with the last, under the name of *Rhizocarpeæ*.

1. AZOLLA, Lam.

Small moss-like plants, the stems pinnately branched, covered with minute imbricating 2-lobed leaves, and emitting rootlets on the under side. Conceptacles in pairs beneath the stem, either both containing macrospores, or one of each kind: smaller conceptacles acorn-shaped, containing at the base a single macrospore, and in the upper part several corpuscles of unknown character. Larger conceptacles globose, having a basal placenta which produces many pedicelled sporangia containing several masses of microspores.

In a paper on *Azolla Nilotica* by Mettenius (in Plantæ Tinneanæ) is found one of the best attempts to explain the curious fructification of this genus. Four species are described.

1. **A. Caroliniana**, Willd. Plant 4 to 12 lines broad, much branched: leaves with ovate lobes, inferior lobe reddish, superior one green with a reddish border: corpuscles three to each macrosporangium; macrospores with a minutely granulate surface: masses of microspores glochidiate. — Sp. Pl. v. 541; Mettenius, Linnæa, xx. 278, t. 3, fig. 9–15, and Pl. Tinneanæ, 53; Gray, Manual, 5 ed. 606, t. 14. *A. microphylla*, Kaulf. Enum. 273.

Floating, commonly on quiet waters, not rare. Oregon to Arizona, eastward to the Atlantic, and southward to Brazil. An inconspicuous plant, looking like a purplish Hepatic moss. *A. Magellanica* is kept apart by Mettenius under the name of *A. filiculoides*, Lam.

Subclass II. CELLULAR ACROGENS.

Plants composed of cellular tissue only. Antheridia or archegonia, or both, formed upon the stem or branches of the plant itself, which is developed from the germinating spore usually with the intervention of a filiform or conferva-like prothallus.

Order CXXVI. MUSCI.

Low and mostly cespitose or tufted plants, caulescent and with distinct sessile simple mostly 1-nerved leaves, alternate in several ranks or rarely distichous, the stems bearing spore-cases which contain only simple spores and open usually by a deciduous lid. Inflorescence diœcious, monœcious, or bisexual, involucrate and mostly bud-like, terminal or lateral, the reproductive organs accompanied by jointed filaments (*paraphyses*). Male flowers (involucre, when present, called the *perigonium*) of several (1 to 20) clavate persistent *antheridia*, opening by an apical slit and discharging a mucous fluid filled with oval cells, each containing an antherizoid. Female flowers (the involucre termed the *perichætium*) of 1 to 20 flask-like *archegonia* (or *pistillidia*), each inclosing a nucleus and terminated by a funnel-mouthed tube (*style*), usually but one becoming fertilized, when the enlarging nucleus bursts the envelope and elongates, the lower part forming a slender pedicel sheathed by the base of the envelope (*vaginule*), the summit becoming a *capsule* bearing the upper part of the archegonium as a *calyptra*. Capsule rarely indehiscent or dehiscing by 4 valves, usually opening by a lid (*operculum*), which leaves the mouth of the capsule naked or surrounded by a ring (*peristome*) of usually 16 *teeth*, distinct or coherent by pairs or more or less divided, with or without a variously divided inner ring, the base of the peristome often encircled by an elastic ring of cells (*annulus*). The pedicel continues through the capsule as a *columella*, and is often thickened under the base of the capsule, forming a *collum* (or *apophysis*) or, if only at one side, a *struma*. The calyptra either splits at one side (becoming *cucullate*, or *dimidiate* if cleft to the apex), or remains entire and campanulate or mitre-shaped (*mitriform*). The *sporangium* lines the cavity of the capsule and contains the spores, which are formed by fours within mother-cells. Spores in germination producing a confervoid branching prothallus, developing buds which become leafy stems. Propagation also takes place by means of *gemmæ*, or by detached leaf-buds, or by the formation of a new prothallus from the roots or from the root-like hairs (*rhizoids*) which often abound upon the stems.

An order of perhaps 150 genera and nearly 4,000 species, distributed over the entire globe, but most abundantly in temperate and cooler regions. They love especially damp or shaded places, and are found upon rocks, trees, the ground, or in running streams, each genus or species having its peculiar preference. They vary much in size, from stems $\frac{1}{2}$ of a line to 1 or 2 feet in length, but in diameter only from $\frac{1}{10}$ to $\frac{1}{2}$ of a line. The stem is composed of more or less elongated and narrow cells, the outermost layers usually much thickened and of a bright red or reddish color. It is occasionally stoloniferous at base, more frequently branching above and extending by a series of vigorous lateral shoots or *innovations*. The leaves are formed usually of a simple layer of cells, with commonly a medial vein or *costa*, consisting of several layers. The tissue (*areolation*) of the blade is homogeneous in each layer, though the cells may vary much in form and size in the same leaf, being usually larger and more elongated toward the base, as well as thinner and destitute of chlorophyll. Cells which are placed end to end are said to be *prosenchymatous*; those

which overlap at the ends are *parenchymatous*. Their outer surface may be smooth or produced into simple or forked papillæ. These characteristics of leaf-structure are largely relied upon in the definition of the tribes, as well as frequently of genera and species. The systematic arrangement of the mosses is still to some extent unsettled. The limits of genera vary very much with different authorities, and the principles which govern their disposition vary as widely. In the following arrangement, while adopting essentially the method developed by Schimper most fully in the second edition of his Synopsis Muscorum Europæorum, his groupings are modified by a consolidation of some of the tribes, while less prominence is given to the numerous minor divisions proposed by him. Under the last tribe *Hypneæ* it has seemed advisable to deviate frequently from his order. It has not been found always easy to express clearly and definitely the distinctions which determine the several tribes and genera, but it is hoped that the key will in most cases serve satisfactorily its intended purpose. The descriptions of the genera and species are drawn almost wholly from published works, and are intended only as a temporary aid to the study of the western species pending the publication of the more critical and authoritative Manual of North American Mosses, by Messrs. Leo Lesquereux and Thomas P. James, which is now in course of preparation. Acknowledgments are due to Mr. James for assistance in questionable cases of synonymy, range, etc.

I. Capsule without operculum, dehiscing irregularly. Fruit terminal on the main stem.

Tribe I. PHASCEÆ. Minute terrestrial plants, stemless and bud-like or with a short mostly simple stem. Capsule rarely exserted, globose to ovate-oblong. Flowers monœcious or sometimes bisexual.

* Prothallus filamentose, persistent: leaves coarsely serrate or incised, the areolation loose and uniform: columella none.

1. **Ephemerum.** Very minute, annual. Calyptra campanulate. Capsule globose-ovate, apiculate, subsessile.

* * Prothallus not persistent: leaves entire or nearly so, the areolation narrower toward the apex: columella present.

\+ Leaves broadly lanceolate, crowded, more or less papillose.

2. **Sphærangium.** Acaulescent, bud-like, with deeply concave subscarious leaves. Capsule globose, not apiculate, immersed. Calyptra mitriform.
3. **Phascum.** Stouter, more caulescent. Leaves broadly lanceolate. Capsule subglobose to ovate-oblong, apiculate. Calyptra cucullate.

\+ \+ Leaves narrowly lanceolate, the lower remote, not papillose, shining: stem at length branching below the summit.

4. **Pleuridium.** Capsule ovate-globose, without collum, apiculate, shortly pedicellate. Calyptra cucullate. Male flowers axillary or hypogynous.
5. **Bruchia.** Capsule ovate-oblong, with large thick collum, rostellate, exserted. Calyptra mitriform. Male flowers terminal, bud-like.

II. Capsule dehiscing by a deciduous operculum. Fruit terminal on the main stem or rarely on short lateral branches.

Tribe II. POTTIEÆ. Caulescent perennials (or annuals in *Pottia*), with the areolation round-hexagonal above, mostly looser and hyaline and more rectangular at the base of the leaves. Flowers bud-like. Calyptra cucullate (mitriform in a species of *Pottia*), long-beaked. Capsule without collum, erect or nodding, on an exserted pedicel. Peristome simple, of 16 teeth, entire or bifid or more or less completely divided, sometimes imperfectly developed or wanting.

* Leaves alternate, in several ranks.

\+ Peristome none (except in a species of *Pottia*): capsule subglobose to oblong: operculum obliquely rostrate or obtuse.

6. **Gymnostomum.** Low perennials, on rocks. Leaves lanceolate or linear-lanceolate, of close firm texture, crenulate or subserrate. Capsule long-pedicellate, and conic operculum long-rostrate.
7. **Pottia.** Very small terrestrial annuals or biennials. Leaves soft, oblong or oblong-obovate, rarely serrate. Capsule immersed or exserted, and the plano-convex or conic operculum more or less rostrate or obtuse.

\+ \+ Peristome-teeth entire or bifid at the apex or unequally cleft to or below the middle: capsule more or less oblong or cylindrical, long-pedicellate: leaves lanceolate.

8. **Weissia.** Teeth entire or bifid at the apex only. Capsule oval or oblong, erect. Leaves entire, involute and crisped when dry.
9. **Dicranum.** Teeth unequally cleft to the middle. Capsule nodding or erect, often incurved. Leaves frequently serrate toward the apex, often large.

+ + + Peristome-teeth dividing to the base, the usually filiform divisions mostly equal, wholly distinct or more or less coherent in pairs. Capsule oblong or cylindrical, long-pedicellate.

++ Peristome without basilar membrane: leaves dull and papillose.

10. **Ceratodon.** Leaves lanceolate: capsule subcernuous, striate becoming sulcate. Teeth cleft nearly to the base, the equal distinct divisions prominently jointed.
11. **Didymodon.** Leaves linear or linear-lanceolate. Capsule erect. Teeth short and fugaceous, entire or cleft to the base into filiform divisions.

++ ++ Peristome upon a more or less produced basal membrane: capsule erect.

= Leaves smooth and shining.

12. **Leptotrichum.** Leaves lanceolate-subulate, not crisped when dry. Teeth equally or unequally cleft to the base, the divisions distinct or coherent. Basal membrane narrow.

= = Leaves dull and papillose.

13. **Trichostomum.** Leaves linear or lanceolate, mostly acuminate. Teeth often imperfect, equally divided, the filiform divisions rarely wholly distinct, erect or slightly twisted.
14. **Desmatodon.** Leaves soft, broader ovate- or obovate-oblong, obtuse or obtusish. Teeth as in the last, rather short and subulate, incurved when dry.
15. **Barbula.** Leaves various. Filiform divisions distinct, mostly very long and twisted.

* * Leaves opposite, distichous.

16. **Fissidens.** Leaves infolded at base, equitant (a dorsal wing produced into a vertical blade). Capsule oval or oblong, cernuous. Teeth as in *Dicranum*, filiform-lanceolate, horizontally inflexed when dry.
17. **Distichium.** Leaves subulate-setaceous, spreading, shining. Capsule oblong or cylindrical, erect or nodding. Teeth subentire or bifid.

TRIBE III. GRIMMIEÆ. Caulescent perennials, with dull leaves in several ranks, the areolation minutely round-hexagonal or punctate above, and hexagonal or linear and often sinuous at base. Flowers bud-like. Calyptra mostly mitriform, smooth or sulcate and often hairy. Capsule erect or sometimes nodding, pedicellate, usually regular. Peristome single or double, or sometimes none; teeth 4, 8 or 16, entire or more or less bifid, usually flattened; cilia alternate with them when present.

* Peristome none.

+ Leaves nerveless, hyaline at the apex: capsule not striate nor apophysate.

18. **Hedwigia.** Capsule globose, immersed. Calyptra mitriform, covering only the convex or umbonate operculum.
19. **Braunia.** Capsule long-pedicellate, turbinate. Calyptra cucullate, covering the capsule. Operculum conic, obtuse.

+ + Leaves costate, not hyaline at the apex: capsule 8-striate, with obconic collum.

20. **Zygodon.** Capsule scarcely exserted, ovate, becoming urceolate. Calyptra cucullate, covering the obliquely short-beaked operculum.

* * False peristome of four rigid triquetrous entire teeth.

21. **Tetraphis.** Capsule cylindric, long-pedicelled. Calyptra mitriform, naked, irregularly sulcate. Leaves ovate-lanceolate, costate.

* * * Peristome single, purple or orange, of 16 distinct teeth, entire or more or less deeply cleft, often perforated: capsule rarely striate or sulcate.

+ Calyptra not plicate nor hairy.

22. **Grimmia.** Low, growing in circular more or less compact tufts. Leaves often setosely tipped. Calyptra lobed-mitriform or cucullate, smooth. Operculum obtuse or shortly beaked. Capsule erect or nodding, immersed or shortly exserted.
23. **Rhacomitrium.** Taller, cespitose. Leaves often denticulate-acuminate. Calyptra lobed-mitriform, rough-beaked. Operculum narrow, mostly aciculate-beaked. Capsule erect, usually long-pedicellate.

+ + Calyptra lobed-mitriform, plicate.

24. **Ptychomitrium.** Rather tall, tufted. Leaves linear-lanceolate, denticulate above. Capsule erect, long-pedicellate, with aciculate operculum.

* * * * Peristome double or single, or rarely none (in *Encalypta*), usually pale, of 16 entire teeth, not perforated, often in pairs: capsule mostly striate and at length sulcate, erect: calyptra large, mitriform or campanulate, often hairy.

25. **Orthotrichum.** Calyptra campanulate, plicate. Capsule immersed or exserted, apophysate. Operculum short-conic. Teeth mostly in pairs, usually reflexed when dry, with often 8 or 16 inner cilia.
26. **Encalypta.** Calyptra long-cylindric, rostrate, not plicate. Capsule long-pedicelled, without collum. Operculum long-beaked. Peristome single or none.

Tribe IV. FUNARIEÆ. Annuals or perennials, mostly terrestrial, with soft smooth pale costate leaves, composed of large thin-walled hexagonal or oblong-rhombic parenchymatous cells. Flowers terminal, the male discoid or capitate. Calyptra conic or mitriform or vesicular-cucullate, naked, not plicate. Capsule apophysate, long-pedicellate, erect and regular or nodding and gibbous. Peristome of 16 teeth, distinct or in pairs, or none; cilia opposite them when present.

* Capsule erect, regular, upon a long-obconic or greatly dilated apophysis: peristome single, reflexed when dry: calyptra mitriform or conic.

27. **Tayloria**. Collum long-obconic. Calyptra mitriform, cleft at one side. Teeth distinct, divided, narrow, reflexed-spreading when dry. Perennials.
28. **Splachnum**. Apophysis at length greatly enlarged, subglobose to umbrella-shaped. Calyptra conic, small. Teeth lanceolate, in pairs, closely reflexed when dry. Annuals.

* * Calyptra vesicular, lobed at base or cucullate, long-beaked: capsule pyriform with an obconic collum, erect and regular, or more or less declined and gibbous; operculum flat-convex to convex-conic: peristome none, single, or double. Annuals.

29. **Physcomitrium**. Calyptra 5-lobed at base. Capsule erect. Peristome none.
30. **Entosthodon**. Calyptra cucullate. Capsule erect. Peristome of 16 short horizontal teeth.
31. **Funaria**. Calyptra cucullate. Capsule more or less nodding. Peristome of 16 oblique teeth and 16 cilia opposite them.

Tribe V. BRYEÆ. Perennials, on the ground or rocks. Leaves with the somewhat uniform areolation wholly parenchymatous, or at least at base. Male flowers discoid or bud-like. Calyptra naked, cucullate, narrow, fugacious. Capsule pyriform or oblong, or subspherical (in *Bartramia*), rarely erect, annulate. Operculum convex or depressed-conic, rarely short-rostellate. Peristome double (sometimes single in *Bartramia*).

* Leaves smooth: capsule not striate nor plicate, oblong or pyriform: peristome of 16 outer teeth and an inner membrane bearing as many alternate carinate or divided processes.

\+ Inner membrane reaching to the middle of the long-lanceolate teeth, and bearing 16 carinate jointed processes, often more or less dehiscent, and usually with ciliolæ in the intervals: leaves often bordered.

32. **Leptobryum**. Stem simple or innovating at base. Leaves linear-setaceous, with linear-rhombic areolation, not bordered. Capsule ovate-pyriform; sporangium small, stipitate.
33. **Bryum**. Stems innovating sparingly, mostly at the summit. Leaves usually ovate or lanceolate, with rather large rhombic areolation. Capsule pyriform or oblong, with obconic collum. Paraphyses of male flowers filiform.
34. **Mnium**. Larger, mostly innovating near the base, and often stoloniferous. Leaves broad, with usually spinulose-serrate thickened border and large round-hexagonal areolation. Capsule oval or oblong with short collum. Paraphyses clavate.

\+ \+ Inner membrane reaching to the middle of the lanceolate teeth, the processes divided into 4 nodose-filiform cilia coherent at the apex; ciliolæ none: leaves not bordered.

35. **Timmia**. Innovations at the summit. Leaves long-lanceolate, with minute round-hexagonal areolation. Capsule oblong-oval with small collum.

\+ \+ \+ Inner membrane short, bearing 16 carinate processes much longer than the short obtuse outer teeth; ciliolæ none: leaves not bordered.

36. **Meesea**. Leaves narrowly lanceolate, obtuse, with minute hexagonal-rectangular areolation. Capsule pyriform, incurved. Paraphyses clavate.

* * Leaves papillose, not bordered, lanceolate: capsule striate, at length plicate: peristome as in the *Bryum* group, rarely simple: innovations at the summit.

37. **Aulacomnium**. Leaves with granular dot-like areolation. Capsule nodding, oblong with distinct collum. Inner teeth of peristome dehiscent; ciliolæ (2 or 3) present.
38. **Bartramia**. Leaves papillose both sides. Capsule globose. Inner teeth divided, the segments divergent, with imperfect ciliolæ, or the inner peristome wanting.

Tribe VI. POLYTRICHEÆ. Terrestrial rhizomatous perennials, of firm texture. Leaves narrow, more or less rigid and serrate, with dense round-hexagonal areolation, the dilated costa lamellate above. Flowers mostly dioecious, the male discoid and proliferous. Calyptra cucullate, subspinulose or hairy. Capsule long-pedicelled; annulus none. Peristome simple, of 32 or 64 short solid obtuse ligulate incurved teeth, adherent at top to a membrane closing the orifice of the capsule.

* Capsule terete, not distinctly apophysate: teeth 32.

39. **Catharinea**. Leaves with a thickened narrow border, the narrow costa 2–6-lamellate. Calyptra naked, spinulose at apex. Capsule cylindrical or oblong, slightly arcuate.
40. **Oligotrichum**. Leaves not bordered, remotely serrulate, the dilated costa with numerous lamellæ. Calyptra sparingly villous with erect hairs. Capsule erect, ovate-oblong.

41. **Pogonatum.** Calyptra copiously villous, the hairs attached to the apex and covering the capsule. Otherwise as the last.

* * Capsule distinctly apophysate, 4-angled ; teeth 64.

42. **Polytrichum.** Calyptra and rigid leaves as in *Pogonatum*. Capsule quadrangular-ovate or -oblong, separated by a stomatose band from a discoid or subglobose apophysis.

Tribe VII. BUXBAUMIÆ. Minute nearly acaulescent annuals or biennials, on the ground or rotting wood. Calyptra conic or cylindric-campanulate. Capsule large, strongly gibbous-ventricose. Peristome double, the outer rudimentary or of one or more rows of small more or less perfect teeth, the inner a 16- or 32-plicate membrane twisted into a cone.

43. **Buxbaumia.** Capsule oblique, obliquely flattened above, long-pedicelled. Inner peristome 32-plicate.

III. Capsule dehiscent by an operculum. Flowers all axillary, bud-like. Perennials.

Tribe VIII. FONTINALEÆ. Floating, slender. Leaves 3-ranked, smooth, with narrow linear or rhombic areolation. Flowers dioecious ; perichætium elongated. Calyptra conic or cucullate. Capsule immersed or exserted, erect, ovate to cylindrical ; operculum conic ; annulus none. Peristome double, of 16 linear teeth, in pairs, and as many alternate cilia more or less united by crossbars.

44. **Fontinalis.** Leaves nerveless, ovate or ovate-lanceolate ; areolation linear-rhombic. Capsule sessile, immersed. Teeth coherent at the apex, hygroscopic ; the inner cilia forming a more or less perfectly tessellated cone.

45. **Dichelyma.** Leaves narrow, falcate, folded, costate : areolation rhombic. Capsule pedicellate. Teeth dehiscing, scarcely hygroscopic ; cilia united or free.

Tribe VIII. HYPNEÆ. Creeping on the ground, trees or rocks, the erect or ascending or pendulous secondary stems branching irregularly, fasciculately, or pinnately. Leaves several-ranked, mostly broad, usually more or less imperfectly costate or bicostate ; areolation various. Calyptra usually cucullate and naked. Peristome double, as in *Mnium*, with or without ciliolæ and the basal membrane often narrow, or the inner peristome rarely wanting (in *Fabronia*).

* Capsule symmetrical, mostly erect : areolation parenchymatous.

+ Stems irregularly or fasciculately branched : capsule long-pedicelled : leaves smooth and shining (except in n. 49, 50), complanate in n. 47.

++ Areolation very loose : flowers monœcious.

46. **Fabronia.** Minute. Leaves not complanate, ovate-lanceolate, filiform-acuminate, dentate or ciliate, obsoletely costate. Calyptra cucullate. Capsule erect, subspherical. Peristome simple.

47. **Hookeria.** Prostrate, succulent. Leaves complanate, ovate or rounded, nerveless or bicostate. Calyptra conic-mitriform. Capsule cernuous or horizontal. Peristome double, without ciliolæ.

++ ++ Areolation narrow or linear : flowers dioecious.

48. **Pterogonium.** Branches arcuate when dry. Leaves bicostate at base. Calyptra slightly hairy. Processes half as long as the teeth, on a broad membrane : ciliolæ none.

49. **Pterigynandrum.** More or less prostrate. Leaves rough-papillose on the back. Peristome-teeth remotely jointed, the processes imperfect and ciliolæ none.

++ ++ ++ Areolation minute and punctiform : leaves densely papillose both sides : flowers dioecious.

50. **Anomodon.** Stems ascending or erect. Leaves costate. Processes shorter than the teeth, without ciliolæ.

+ + Stems pinnately or bipinnately branched : flowers dioecious.

++ Capsule very shortly pedicellate : leaves smooth and shining ; areolation narrow or linear. Secondary stems erect, ascending, or pendulous.

51. **Neckera.** Leaves complanate, scarious, ovate-lanceolate, scarcely costate. Processes as long as the teeth ; ciliolæ none.

52. **Antitrichia.** Leaves not complanate, ovate-acuminate, costate to the middle. Processes shorter, fugacious.

++ ++ Capsule short- or long-pedicellate : leaves smooth or papillose ; areolation oval-rhombic or punctiform.

53. **Alsia.** Branching stems often circinate when dry. Processes shorter than the teeth, with or without ciliolæ.

* * Capsule unsymmetrical, long-pedicelled, more or less cernuous : ciliolæ present : areolation mostly narrow or linear.

54. **Hypnum.** Leaves mostly smooth and shining, rarely complanate, often secund.

1. EPHEMERUM, Hampe.

Very minute gregarious annuals, on bare damp earth; filamentous prothallus persistent, erect and much branched; stem very short, simple. Leaves soft, ovate to oblong-lanceolate, coarsely serrate or incised; areolation loose, rhombic-hexagonal. Male plants near the base of the somewhat larger female and upon the same prothallus, of 3 or 4 leaves and bud-like, with a few minute oblong antheridia, deciduous at maturity. Calyptra thin, campanulate, incised at base. Capsule immersed or emergent, subsessile, acuminate-ovate or globose, without columella. Spores not many, large, reniform.

Eight species are found in Europe and North America.

1. **E. serratum,** Hampe. Prothallus deep green, dense and velvety: stem with long rootlets: lower leaves ovate, acuminate, ecostate, much smaller than the long-lanceolate upper ones; teeth usually spreading or recurved: capsule subglobose, shortly acuminate, brownish purple, shining: spores 50 to 100, ferruginous. — Bruch & Schimp. Bryol. Eur. t. 1; Schimp. Syn. 2 ed. t. 1. *Phascum serratum,* Schreb. Phasc. 9, t. 2; Wilson, Bryol. Brit. t. 5; Sulliv. in Gray's Manual, 2 ed. 614.

In fields and meadows, Mission Dolores (*Bolander*); also in the Atlantic States and throughout Europe.

2. SPHÆRANGIUM, Schimp.

With nearly the habit of *Ephemerum,* the prothallus often absent: leaves of firmer texture, imbricate, ovate to ovate-oblong or obovate, concave or carinate, costate, minutely papillose toward the apex and the areolation closer than below; chlorophyll scanty or wanting. Calyptra minute, mitriform, irregularly circumscissile at base, very fugaceous. Capsule immersed, erect on a short pedicel or subpendulous, globose, shining, brownish-orange; columella present, thickish. Spores subglobose. — *Acaulon,* Muell.

Four species are known, two of Europe and the Atlantic States, one Texan, and one Australian.

1. **S. muticum,** Schimp. Bud-like, the fruiting plant oblong-conical, pale or brownish: lower leaves ovate-acuminate, more or less recurved, the middle ovate-oblong, recurved-acuminate, not carinate, mucronate with the excurrent costa, the upper 2 (or 3) infolding each other, often deeply erose at the apex, 3 times longer than the erect orange-colored capsule. — Syn. Muse. Eur. 2 ed. 13, t. 1; Bruch & Schimp. Bryol. Eur. t. 4. *Phascum muticum,* Schreb. Phasc. 8, t. 1, fig. 11, 12. *Acaulon muticum,* Muell.; Sulliv. & Lesq. Muse. Am.-Bor. Exsicc. 2 ed. n. 32.

At Mission Dolores, with the last (*Bolander*); Atlantic States, Europe and South Africa.

S. TRIQUETRUM, Schimp., if it occurs in California, may be distinguished by its 3-ranked carinate leaves, the perichætial always 3, and the capsule horizontal upon the curved pedicel. The Atlantic States form is said to be intermediate between the two.

3. PHASCUM, Linn.

Stouter than the preceding, rarely annual and usually reproduced from the base, growing on the ground, the prothallus soon disappearing. Stem simple or 2–3-parted. Leaves rather firm, costate, broadly lanceolate, entire; areolation below loose, oblong and hyaline, minutely subquadrate and chlorophyllose above. Male flowers at the base of the stem or branches, with 1 to several perigonial leaves. Calyptra cucullate. Capsule shortly pedicellate, subglobose to ovate-oblong, apiculate or beaked, with free sporangium and persistent columella. Spores smaller.

Only the following species are found in America, both also European; other species belong to the Old World. The genus approaches *Pottia*, except in the want of an operculum.

1. **P. cuspidatum,** Schreb. Densely clustered; stems simple or somewhat branched, about 2 lines high: leaves densely crowded at least above, oblong-lanceolate and long-acuminate, cuspidate with the excurrent costa, carinate-concave, the margin subrevolute below, more or less papillose on the back toward the apex: male flower with one perigonial leaf: capsule immersed, globose or rarely ovate, shortly and obtusely apiculate, chestnut-colored. — Bruch & Schimp. Bryol. Eur. t. 5; Schimp. Syn. Musc. 2 ed. 16, t. 1; Sulliv. in Gray's Manual, 2 ed. 615, t. 1.

At Mission Dolores, with the preceding (*Bolander*); common in the Atlantic States and throughout Europe, and in most temperate regions, in various forms.

2. **P. bryoides,** Dickson. Cespitose; stems 2½ to 5 lines high, simple or branched, at length decumbent and reproduced from the base: lower leaves minute and remote, the upper much larger, connivent or somewhat spreading, oblong- to long-lanceolate, concave, cuspidate: male flower terminal, becoming apparently axillary: capsule emergent or wholly exserted, erect upon a straight pedicel, oval to oblong-elliptical with an oblique blunt beak, brown, dull. — Bruch & Schimp. l. c., t. 6; Berkeley, Brit. Moss. t. 24, fig. 8.

Var. **piliferum,** Schimp. Leaves shorter, piliferous: capsule ovate, on a shorter pedicel. — Syn. Musc. 2 ed. 19.

South side of Oakland Hills (*Bolander*), the variety; also European.

4. PLEURIDIUM, Bridel.

Annuals or the stem at length decumbent and producing innovations or flagelliform branches below the apex. Leaves lanceolate or lance-subulate, shining, firmly costate, remotely and obtusely serrate toward the apex, the areolation oblong-hexagonal below, narrower above. Inflorescence monœcious or bisexual. Calyptra small, cucullate. Capsule immersed or exserted upon a short pedicel, becoming lateral after the branching of the stem, ovate-globose or ovate, shortly apiculate, smooth and shining. — *Astomum,* Hampe.

Ten species are described, three European, three North American, the rest of the southern hemisphere.

1. **P. subulatum,** Bruch & Schimp. Stem 1 to 3 lines high, rarely branched: upper leaves crowded, erect-spreading and somewhat secund, much exceeding the capsule, lance-subulate and subsetaceous, not carinate, the broadish costa ceasing near the obsoletely serrate apex: antheridia naked in the axils of the perichætial leaves: capsule ovate-globose, pale brown. — Bryol. Eur. t. 9. · *Phascum subulatum,* Linn.; Hedw. Musc. Frond. i. 93, t. 35; Engl. Bot. t. 2177; Wilson, Bryol. Brit. t. 5; Austin, Torr. Bot. Bull. vi. 142.

Var. Stem stoloniferous: leaves broader at base, more convolute, and smooth upon the back; the inner perichætial leaves not narrower, more abruptly contracted. — *P. subulatum,* Lesq. in Trans. Am. Phil. Soc. xiii. 2, and Mem. Calif. Acad. i. 5; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 39, in part. *P. stramineum,* Lesq.; Austin, l. c.

The variety at San Rafael, by ditches and on dry hills, *Bolander.* Intermediate between the typical European *P. subulatum* and the Atlantic States form (also referred to it by Sullivant), which Austin has distinguished as *P. Ravenellii.*

5. BRUCHIA, Schwaegr.

Cespitose or densely clustered, with the habit of *Pleuridium:* stems simple or sparingly branched: leaves shining, the lower minute and remote, the upper crowded

and much larger, lanceolate-subulate, with excurrent costa; areolation rectangular below, narrower above: inflorescence monœcious, the male flowers terminal upon special branches, with open perigonium: capsule exserted, ovate with a large solid collum, beaked: calyptra mitriform, lobed or lacerate at base.

Five species are found in the Atlantic States, two in Europe, and several others in South America and Southern Africa.

1. **B. Bolanderi,** Lesq. Stems clustered, simple, scarcely a line long: leaves pale green, erect-spreading, shortly subulate above the lanceolate base, the costa ceasing at the obscurely serrulate apex; perichætial leaves broader, nearly tubular, the outer shortly acuminate, the inner lanceolate-subulate, erect, twice or thrice longer than the cauline; inner perigonial leaves brownish, ovate-lanceolate, acute, obsoletely nerved: calyptra lobed at base: capsule erect or nearly so upon a stout pedicel 2 to 4 lines long, greenish, narrowly oblong with a straight pale beak, upon an elongated pale green collum. — Mem. Calif. Acad. i. 5; Sulliv. Icon. Musc. Suppl. 23, t. 14.

Near the Mariposa Grove and at Westfall's Meadow, *Bolander.* Resembling the European *B. Vogesiaca,* Schwaegr.

6. GYMNOSTOMUM, Hedw.

Low slender cespitose perennials, on rocks; stems 2 – 3-dichotomous. Leaves in several ranks, lanceolate to linear, with prominent costa and minute quadrate areolation, larger and hyaline at base. Inflorescence monœcious or dioœcious, the male terminal and bud-like. Calyptra cucullate, deeply cleft, long-beaked. Capsule erect upon a rather long pedicel, elliptic-ovate or subglobose, with long-beaked operculum, annulate (our species), but without peristome.

Three species are European and North American, with single species in South America and Africa. Differing from *Weissia* only in the want of a peristome, and referred to it by Mueller and Mitten.

1. **G. calcareum,** Nees & Hornsch. Very densely cespitose, 2 to 10 lines high, bright green above, ferruginous below: leaves erect-spreading, linear or linear-lanceolate, somewhat obtuse, minutely serrulate: calyptra very narrow: capsule oblong upon a pale straw-colored pedicel, subcylindrical when empty, pale brownish with a red orifice; operculum conic with acute or subulate beak; annulus persistent. — Bryol. Germ. 153, t. 10; Bruch & Schimp. Bryol. Eur. t. 32.

Var. **perpusillum,** Sulliv. Very small, with erect ovate-lanceolate crenulate leaves, and oval-pyriform capsule. — Pacif. R. Rep. iv. 185.

On clayey soil near San Francisco, *Bigelow;* the variety. The typical form was found at Lake Winnipeg by *Drummond,* and is common in Europe.

G. CURVIROSTRUM, Hedw. (Musc. Frond. ii. 68, t. 24; Bruch & Schimp. l. c., t. 35, 36), was collected by *Bigelow* at Leroux Springs at the base of the San Francisco Mountains, Arizona. It is taller (½ to 4 inches high) and very much branched, with lanceolate acute and often subserrate leaves: capsule ovate to subspherical, brown and shining, with a broadly conic operculum produced into a long oblique slender beak and long persistent upon the prominent columella.

7. POTTIA, Ehrh.

Small terrestrial annuals or biennials. Leaves in several ranks, soft, dull, smooth or papillose, oblong to oblong-obovate, acuminate, the excurrent costa sometimes lamellate on the upper side; areolation looser and hyaline at base. Flowers monœcious, the male axillary, bud-like or naked. Calyptra smooth, cucullate or rarely mitriform. Capsule erect, immersed or exserted, ovate-oblong or truncate-obovate, with depressed-conic obliquely rostrate or obtuse operculum. Peristome none or rudimentary, rarely of 16 entire or bifid teeth. — *Anacalypta,* Roehl.

A genus of about 40 species, 13 European. Nearly allied to the *Barbula* group, with which it is sometimes united.

* *Peristome none or rudimentary.*

+ *Leaves lamellate on the upper side of the costa, which terminates in a long seta.*

1. **P. cavifolia,** Ehrh. Leaves erect-spreading and subimbricate, obovate-oblong, strongly concave, bearing 3 or 4 membranous lamellæ on the costa: capsule emergent or exserted upon a short pedicel (1 to 6 lines long), ovate to oblong; operculum rather long-beaked; annulus none. — Bruch & Schimp. Bryol. Eur. t. 118; Wilson, Bryol. Brit. t. 7. *Gymnostomum ovatum,* Hedw. Musc. Frond. i. 16, t. 6.

In ditches near Carson City (*Watson*); Fort Colville, Washington Territory (*Lyall*); throughout Europe and in the Andes. Very variable.

2. **P. subsessilis,** Bruch & Schimp. Resembling the last: leaves obovate or obovate-oblong, the costa bearing 2 to 4 thickened or membranaceous lamellæ and ending in a long white seta: calyptra oblique, campanulate, lobed at base: capsule immersed upon a short straight pedicel, subglobose with a large flattened-convex rostellate operculum and very broad mouth. — Bryol. Eur. t. 117; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 92 (2 ed. n. 118). *Schistidium subsessile,* Bridel. *Pharomitrium subsessile,* Schimp. Syn. Musc. Eur. 2 ed. 150.

At Los Angeles (*Bigelow*); near Carson City, under sage-brush (*Watson*); from the Rocky Mountains of British America to Illinois and Texas. Also in South America and in Germany. Separated generically by Schimper upon the character of the calyptra.

+ + *Costa naked, slightly or not at all excurrent.*

3. **P. minutula,** Bruch & Schimp. Stems seldom a line long: leaves spreading, becoming reddish, ovate- or oblong-lanceolate, with recurved margins and the red costa slightly excurrent: antheridia naked in the axils of the perichætium or included within one or two perigonial leaves: capsule minute, on a reddish pedicel a line or two long, truncate-ovate, with a large obtusely conical operculum. — Bryol. Eur. t. 119; Wilson, l. c.; Sulliv. & Lesq. l. c., n. 91 (2 ed. n. 117). *Gymnostomum minutulum,* Schwaegr. Suppl. i. 25, t. 9.

At Los Angeles (*Bigelow*); through Europe and in Northern Africa.

4. **P. truncata,** Bruch & Schimp. Stems ½ to 6 lines high: leaves spreading, obovate-oblong or subspatulate, shortly acuminate and usually mucronate with the excurrent costa, concave at base and carinate above, the margins flat: capsule truncate-obovate, with an obliquely beaked flat-convex operculum deciduous with the upper portion of the columella. — Bryol. Eur. t. 120; Wilson, l. c.; Sulliv. in Gray's Man. 2 ed. 629, t. 2; Sulliv. & Lesq. l. c., n. 90 (2 ed. n. 116). *Gymnostomum truncatum,* Hedw. Musc. Frond. i. 13, t. 5.

Var. **subcylindrica,** Bruch & Schimp. Leaves ovate-lanceolate, the costa more excurrent: capsule subcylindrical.

Wet meadows near Carson City (*Watson*), the variety. New England to Pennsylvania, and very common throughout Central Europe.

5. **P. Heimii,** Bruch & Schimp. Somewhat taller and stouter: leaves flexuose-spreading, the lower remote and broadly lanceolate, the upper crowded, oblong-lanceolate, acute or acuminate, serrate at the apex, with flat margins and the reddish costa ceasing at or below the apex: inflorescence polygamous: capsule reddish brown, on a pedicel ½ to 1 inch long or less, truncate-obovate or oblong; operculum flat-convex, obliquely long-beaked, remaining attached to the columella. — Bryol. Eur. t. 124; Wilson, l. c.; Berkeley, Brit. Moss. t. 23, fig. 3; Sulliv. & Lesq. l. c., n. 115. *Gymnostomum Heimii,* Hedw. l. c., i. 80, t. 30.

In ditches near Soda Springs on the Upper Tuolumne (*Bolander*); in the West Humboldt Mountains, Nevada, and in the Wahsatch (*Watson*); and in the Rocky Mountains from British America to Colorado. Also in the Andes to Cape Horn, and in Europe.

P. RUBIGINOSA (*Barbula rubiginosa*, Mitten, Journ. Linn. Soc. viii. 27), collected by *Douglas*, may be found in Northern California. It is a dioecious species, with spreading leaves, curved and appressed when dry, the lower ovate, the upper subulate-lanceolate from an ovate decurrent base, acute with the costa reaching the thickish apex, margin recurved, areolation minute, rounded, minutely papillose; perichætial leaves larger, erect, convolute, subulate-apiculate with excurrent costa: capsule oval-cylindric, upon a red pedicel; operculum conic, half as long as the capsule; annulus of a triple row of cells.

*** *Peristome distinct.* — ANACALYPTA.

6. **P. Starkeana,** Muell. Closely resembling *P. minutula*, from which it is distinguished by broader and comparatively shorter leaves, more shortly cuspidate and with narrower and less distinct areolation, the oval capsule with a narrow persistent annulus, and the pale or yellowish peristome of 16 obtuse or truncate 3–4-jointed entire or cribrose teeth. — Syn. i. 547. *Weissia Starkeana*, Hedw. l. c. iii. 83, t. 34. *Anacalypta Starkeana*, Nees & Hornsch.; Bruch & Schimp. Bryol. Eur. t. 125; Wilson, l. c., t. 14; Sulliv. & Lesq. l. c., n. 119.

Mission Dolores, on clayey ground (*Bolander*); also European.

8. WEISSIA, Hedw.

Low cespitose perennials, dichotomously or fastigiately branched, on the ground or on rocks. Leaves in 8 ranks, linear-lanceolate to oblong-subulate, costate; areolation minute, quadrate, at base rectangular and hyaline. Inflorescence monœcious, terminal, bud-like. Calyptra cucullate, long-beaked. Capsule erect upon a rather long pedicel, oval or oblong, with rostrate operculum, and peristome of 16 flat lanceolate or truncate teeth, entire or bifid at the apex, transversely jointed and often perforated.

A genus variously limited, represented by a single species in the Atlantic States, by 8 or 9 in Europe, and most abundantly in South America.

* *Perichætial leaves not sheathing: teeth of peristome somewhat irregular.*

1. **W. viridula,** Bridel. Stems about half an inch high, nearly simple or fastigiately branched, in bright green more or less crowded tufts: leaves linear-lanceolate, flexuous-spreading, with very involute margins, crisped when dry, the costa slightly excurrent: capsule ovate to oblong, brown or reddish; teeth very variable, often rudimentary, reddish, 2–5-jointed. — Bruch & Schimp. Bryol. Eur. t. 21; Sulliv. in Gray's Man. 2 ed. 618, t. 1. *W. controversa*, Hedw.; Wilson, Bryol. Brit. t. 15.

Var. Capsule longer, ovate-cylindrical, regularly striate or plicate, green. — Lesq. in Mem. Calif. Acad. i. 6.

On the ground at and around San Francisco, both forms, *Bolander*. A common and very variable species, in the Atlantic States and throughout Europe, on roadsides and in fields and meadows.

* * *Perichætium distinct, sheathing: teeth more perfect, lanceolate.* — (*Dicranoweissia*, Lindb.)

2. **W. cirrhata,** Hedw. Tufted, soft, the taller stems much branched, bright green above, pale ferruginous below: leaves spreading, linear-lanceolate from an oblong-ovate base, crisped when dry, the margins reflexed and costa rarely slightly excurrent; perichætial leaves broader and shorter, somewhat sheathing nearly to the apex: capsule long-oblong, subcylindrical, pale brown with a small reddish orifice, and a persistent annulus of 3 rows of cells: teeth narrowly linear-lanceolate, entire, erect when dry, reddish purple, paler above. — Spec. 69, t. 12; Bruch & Schimp. l. c., t. 25; Wilson, l. c., t. 15. *Dicranoweissia cirrhata*, Schimp.

Common in the redwoods and at the Big Tree groves, especially on burnt and decayed wood (*Bigelow, Bolander*); Washington Territory and Oregon, *Douglas, Lyall*. Also European.

W. CRISPULA, Hedw., ranges from the arctic regions to the mountains of Washington Territory, Utah and Colorado, and may be expected on the high mountains of California. Slender, an inch high or more, with lanceolate long-acuminate leaves, flexuose-spreading or falcate-secund and much crisped when dry: capsule on a tall twisted pedicel, with obliquely beaked operculum, no annulus, and occasionally bifid teeth, the tips incurved when dry. — Bruch & Schimp. l. c., t. 26. *Dicranowcissia crispula*, Schimp.

9. DICRANUM, Hedw.

Dichotomously branched perennials, often large, on the ground, rocks, or rarely trees. Leaves spreading or falcate-secund, long-lanceolate or lance-subulate, costate; areolation quadrate or linear-oblong, hyaline at base, and often enlarged and yellowish at the basal angles; perichætial leaves sheathing. Inflorescence diœcious or monœcious, terminal and bud-like. Calyptra cucullate. Capsule long-pedicellate, nodding or rarely erect, symmetrical or incurved; operculum large, long-beaked. Peristome of 16 linear-lanceolate purple or deep orange teeth, unequally cleft to or below the middle, the longer and shorter segments so alternating as to be in pairs.

There are 60 or more European species, half of which reappear in North America. The genus is resolved by some authors into a tribe of half a dozen or more.

* *Leaves dull, papillose above, crenulate-serrate at the apex, the minutely quadrate areolation not enlarged at the basal angles: calyptra inflated-cucullate: capsule strumous, with oblique operculum: monœcious.* — § CYNODONTIUM. (*Cynodontium*, Schimp.)

1. **D. virens**, Hedw. Stems often tall (3 inches high or less): leaves lanceolate-subulate, half-sheathing at base, spreading, flexuose, smooth, entire or serrate: capsule nodding, more or less incurved, brownish, not striate when dry; annulus narrow, persistent. — Musc. Frond. iii. 77, t. 32; Engl. Bot. t. 1462; Bruch & Schimp. Bryol. Eur. t. 48; Wilson, Bryol. Brit. t. 17.

Var. **serratum**, Bruch & Schimp. Leaves coarsely toothed: capsule less strumous.

On the banks of cold streams in Tuolumne Cañon and Mono Pass, at 9,000 feet altitude (*Bolander*); Galton Mountains, Washington Territory, *Lyall*; the variety. A form (var. *Wahlenbergii*) with narrower more flexuose and strongly crisped leaves, the lower becoming dark-colored, and with the more incurved capsule prominently strumous, occurs eastward. The typical form is European, as well as the varieties.

D. POLYCARPUM, Ehrh., a more slender species, with linear-lanceolate leaves papillose on both sides and denticulate at base and apex, and with the erect or gibbously inclined capsule striate when dry, was found by *Lyall* in the Cascade Mountains. It is common throughout Europe, and occurs eastward. — Engl. Bot. t. 2269; Bruch & Schimp. l. c., t. 47; Wilson, l. c., t. 18.

* * *Small: leaves smooth, more or less serrate above, pale, with oblong-hexagonal areolation uniform at base: calyptra not inflated: capsule seldom strumous, mostly nodding: diœcious.* — § DICRANELLA. (*Dicranella*, Schimp.)

+ *Leaves secund or somewhat so.*

2. **D. varium**, Hedw. Stems densely clustered, 4 or 5 lines high: leaves mostly spreading, lance-subulate and attenuate with slightly excurrent costa, entire or obsoletely toothed at the apex: capsule nodding, ovate or oblong, somewhat incurved, without annulus, red; operculum large, shortly beaked: teeth large, deep purple, connivent into a convex cone. — Musc. Frond. ii. 93, t. 34; Bruch & Schimp. l. c., t. 57, 58; Wilson, l. c., t. 17.

On perpendicular sandstone rocks, watered by springs, near the Bay of San Francisco, *Bolander*. A very common and variable species in the Atlantic States, usually on moist clay banks; also in Europe.

3. **D. subulatum**, Hedw. Stems loosely cespitose, 5 to 10 lines high: leaves secund, somewhat falcate, long-subulate with a slender excurrent costa, entire, shining, very narrowly areolate; capsule nodding upon a red pedicel, gibbous,

obsoletely striate, becoming sulcate, reddish brown and shining, with an annulus of 2 rows of cells; operculum curved, attenuate-subulate: teeth small, incurved when dry. — Spec. 128, t. 34; Bruch & Schimp. l. c., t. 60; Wilson, l. c., t. 18.

Borders of streamlets at foot of Mount Dana, at 8,000 to 10,000 feet altitude (*Bolander*); Galton Mountains (*Lyall*); Rocky Mountains (*Drummond*); White Mountains, New Hampshire, and in alpine or subalpine localities in Europe.

4. **D. heteromallum,** Hedw. Somewhat larger, the simple or 2-parted stems densely crowded: leaves bright green with a silky lustre, secund and somewhat falcate, lanceolate-setaceous, the apex denticulate or nearly entire, the costa not excurrent: capsule nodding or suberect upon a yellowish pedicel, obovate-oblong, slightly curved, obsoletely striate, becoming plicate, with a very narrow annulus; operculum subulate: teeth bifid or 3-cleft. — Musc. Frond. i. 68, t. 26; Engl. Bot. t. 1272; Bruch & Schimp, l. c., t. 62; Wilson, l. c., t. 18.

On ditch-sides in a bog near Redwood City (*Bolander*); Cascade Mountains, *Lyall.* Very common in the Atlantic States and throughout Europe.

D. Schreberi, Swartz. Frond about half an inch high or less, with squarrosely spreading lanceolate-subulate carinate leaves irregularly or obsoletely denticulate toward the apex, and the nodding capsule not striate and without annulus. — Hedw. Spec. 144, t. 33; Wilson, l. c., t. 39; Bruch & Schimp. l. c., t. 53. Near Portland, Oregon, (*Nevius*); also European.

D. crispum, Hedw., found by *Lyall* in the Galton Mountains, is monœcious, with very flexuous divaricately spreading long-subulate leaves, minutely toothed at the apex, and the erect capsule obovate or ovate, striate and at length sulcate, with very narrow annulus; operculum crenulate at base. — Musc. Frond. ii. 91, t. 33; Bruch & Schimp. l. c., t. 55; Wilson, l. c., t. 17.

* * * *Mostly large and showy, rooting at base or often the whole stem tomentose with fine rhizoids: leaves rarely papillose; areolation linear-oblong, very narrow at base, at the basal angles quadrate, enlarged or inflated, yellowish and hyaline: our species dioecious.* — § Dicranum proper.

\+ *Capsule erect, regular.*

5. **D. strictum,** Schleich. Densely cespitose, pale or yellowish-green: stems tomentose: leaves erect-spreading, rather rigid and fragile, lance-subulate, the cells at the angles much dilated and orange-colored: capsule soft and pale, ovate-elongated, with very narrow annulus: teeth irregularly bifid, reddish orange. — Schwaegr. Suppl. i. 188, t. 43; Bruch & Schimp. l. c., t. 66.

On coniferous trees at Devil's Cañon, Forest Hill (*Bolander*); Fort Colville, Washington Territory, *Lyall.* Also European.

D. albicans, Bruch & Schimp. (Bryol. Eur. t. 73), also of this group, was collected by *Douglas* on the western coast. It may be known by its strict or subfalcate narrowly lanceolate leaves, with a very broad costa and strongly incurved margins, yellowish-green, becoming whitish when dry, the basal angles thin and loosely areolate: capsule oblong or long-cylindrical; teeth large, cleft to below the middle. On the ground, maturing fruit in the autumn; in Europe and the Caucasus, alpine or subalpine.

\+ \+ *Capsule nodding, incurved.*

6. **D. fuscescens,** Turner. Cespitose; stems covered with dense yellow tomentum: leaves crowded at the summit, secund and flexuous, lanceolate-subulate, serrate at the apex, deep or pale green, often brownish, the basal cells all dilated: calyptra white: capsule broad-ovate, striate, sulcate when dry; annulus very narrow; operculum with a very long curved beak: teeth purple, 2 – 3-cleft. — Musc. Hibern. 60, t. 5; Engl. Bot. t. 1597; Wilson, l. c., t. 18. *D. congestum,* Bridel; Bruch & Schimp. l. c., t. 77.

In the redwoods (*Bolander*); Spokane River, Oregon (*Pickering*); Galton Mountains, *Lyall.* Common in the Atlantic States, and in Europe on shaded rocks in the mountains; fruiting in early autumn.

7. **D. scoparium,** Hedw. Loosely cespitose; stems 2 to 4 inches high, with white or rusty tomentum: leaves secund, falcate, rarely strict, linear-subulate, sharply serrate, the costa sulcate on the back and toothed toward the apex, the basal

cells somewhat sinuous, those at the angles larger and quadrate: capsule cylindrical, somewhat arcuate, firm, without annulus, brownish upon a reddish pedicel; operculum with a stout red beak as long as the capsule: teeth dark purple. — Musc. Frond. ii, t. 8; Bruch & Schimp. l. c., t. 74, 75; Sulliv. in Gray's Man. 2 ed. 622, t. 2; Berkeley, Brit. Moss. t. 23, fig. 7.

Collected in Oregon (*Pickering*), and also in California (*Bolander*), a form with the leaves scarcely denticulate. A very variable species, very common eastward and in Europe.

8. **D. palustre**, LaPyl. Loosely cespitose; stems 3 or 4 inches long, slender, tomentose to the summit: leaves spreading, very shining, linear-lanceolate, transversely undulate above, serrate toward the apex upon the margin and back, with slender costa vanishing below the apex: capsule oval-oblong upon a slender flexuous pedicel, slightly incurved, distinctly striate; annulus none: teeth as in the last. — Bruch & Schimp. l. c., t. 79; Wilson, l. c., t. 18.

Var. Stems shorter: leaves narrower, scarcely undulate, falcate-secund: capsule longer, more slender, and more incurved. — Lesq. Mem. Calif. Acad. i. 7.

Eureka, Humboldt County (*Bolander*); Washington Territory (*Lyall, Wood*); the variety at Deep Cañon on the Klamath River, *Brewer*. The species is European, and has been collected in Northern Ohio and in British America, growing in marshes.

D. MAJUS, Turner, was collected by *Pickering* at Port Discovery, Washington Territory. It resembles *D. scoparium*, but with more slender stems, prostrate or ascending, and with very long narrower deep green leaves: capsules several from the same perichætium, green (at length blackish) upon shorter and paler pedicels. European. — Musc. Hib. 59, t. 4; Engl. Bot. t. 1408; Schwaegr. Suppl. t. 40; Bruch & Schimp. l. c., t. 85; Wilson, l. c., t. 18.

10. CERATODON, Bridel.

Slender densely cespitose perennials, on the ground, or rarely on rocks, fastigiately branched. Leaves several-ranked, lanceolate, strongly costate, flexuose or rarely strict when dry, dull, papillose or smoothish above, entire; areolation minutely quadrate, near the base looser, more hexagonal and hyaline. Inflorescence dicœcious, terminal: male flowers bud-like. Calyptra cucullate. Capsule slightly nodding, oblong-cylindric, long-pedicellate, striate, deeply sulcate when dry, with broad annulus; operculum conic, subrostrate. Peristome single, of 16 regular linear-lanceolate teeth, equally cleft nearly to the base, papillose and prominently articulated, strongly hygroscopic.

Three species are European, one of them cosmopolitan.

1. **C. purpureus**, Bridel. Tufts soft, reddish- to olive-green, 2 or 3 inches high or less: leaves oblong-lanceolate, carinate, with recurved margins and excurrent costa, dull and smoothish: capsule purplish red and shining, upon a purple pedicel, incurved and 4–5-angled when dry: teeth purple, when dry spirally incurved. — Bruch & Schimp. Bryol. Eur. t. 189, 190; Sulliv. in Gray's Manual, 2 ed. t. 1; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 107[b] (2 ed. n. 160); Berkeley, Brit. Moss. t. 23, fig. 5. *Dicranum purpureum*, Hedw. Spec. 36, t. 36. *Didymodon purpureus*, Hook. & Tayl. Musc. Brit. 65, t. 20.

Var. **xanthopus**, Sulliv. & Lesqx. l. c. Pedicels white.

Common in California (*Bigelow, Brewer, Bolander*); on wet rocks, Yosemite Valley (*Bolander*); on dry rocks in the Hot Spring Mountains, Nevada (*Watson*); the variety on roots and stumps of both species of *Sequoia*, *Bolander*. The most common and cosmopolitan of all mosses, growing from the sea-level to high altitudes in the mountains, and from arctic regions to the tropics.

11. DIDYMODON, Hedw.

Branching cespitose perennials, rooting at the base of the branches. Leaves linear-lanceolate, serrate and densely papillose at the apex, the areolation looser and

hyaline at base. Calyptra long, cucullate. Capsule erect, long-pedicelled, long-cylindric, with rostrate operculum and distinct annulus. Peristome of 16 rather long flat linear-lanceolate fugacious teeth, subentire or more or less divided.

A genus variously understood and often included in *Leptotrichum* and *Trichostomum*. Schimper refers to it about a dozen European species. It differs from *Trichostomum* in its softer and more papillose leaves and in the flattened teeth of the peristome without basal membrane.

1. **D. rubellus,** Bruch & Schimp. Stems slender, ¼ to 1 inch high, in loose mats reddish-ferruginous below: leaves divaricately spreading, crisped when dry, lanceolate and linear, concave and carinate, with revolute margins and papillose both sides, the costa ceasing at the apex: male flowers naked in the axils of the very thin sheathing perichætial leaves: capsule long-cylindric to oblong or oval, green becoming brownish; annulus very fragile: teeth pale or reddish. — Bryol. Eur. t. 185; Wilson, Bryol. Brit. t. 14; Sulliv. in Gray's Man. 2 ed. t. 2; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 106 (2 ed. n. 157).

Near Soda Springs, Tuolumne Cañon (*Bolander*); in the mountains of Nevada and in the Uintas (*Watson*); in the Atlantic States, Europe and Africa. Very variable.

2. **D. cylindricus,** Bruch & Schimp. Stems ¼ to 1 inch high, forming loose flat mats deep or yellowish green above, whitish below: leaves linear-lanceolate, flexuose-spreading, crisped when dry, the flat margins subundulate and minutely crenulate, costa slightly excurrent: capsule narrowly cylindrical, pale brown on a yellowish pedicel, with subulate-beaked operculum, narrow persistent annulus, and very fugacious peristome. — Bryol. Eur. t. 187; Wilson, Bryol. Brit. t. 33; Sulliv. & Lesq. l. c., n. 106[b] (2 ed. n. 158).

West Humboldt Mountains, Nevada (*Watson*); in the Eastern States, Europe and India.

12. LEPTOTRICHUM, Hampe.

Slender cespitose perennials, terrestrial or on rocks. Leaves several-ranked, lance-subulate, smooth and shining, not crisped when dry, the distinct areolation minute and narrowly rectangular above, looser, more hexagonal and hyaline at base; costa mostly excurrent. Flowers monœcious or dioœcious, terminal and bud-like or the male axillary. Calyptra cucullate. Capsule erect on a long straight pedicel, ovate to cylindrical; operculum rostrate. Peristome of 16 rather long teeth cleft to the base, or the filiform papillose slightly hygroscopic divisions more or less connate.

Closely allied to the following genus, with which it is often united. Eight species are European, five of them also North American; ten others are South American.

1. **L. Schimperi,** Lesq. Stems low, 3 or 4 lines high, subsimple, yellowish green: leaves spreading, flexuous or falcate-secund, long and narrowly subulate from an ovate base, subdenticulate at the apex; costa slender, excurrent: inflorescence monœcious, the male flowers axillary, with large short and obtuse perigonial leaves; perichætial leaves broadly clasping, long-attenuate: capsule brown, ovate-cylindrical, upon a yellowish pedicel scarcely over an inch long; operculum long-conic, dark red: teeth pale yellow, filiform and smooth, upon an orange or reddish basilar membrane thrice broader than the annulus: spores very large. — Mem. Calif. Acad. i. 9; Sulliv. Icon. Musc. Suppl. 37, t. 24.

In the Coast Ranges, Mendocino County, *Bolander*. Resembling *L. pallidum*, Hampe, of the Atlantic States and Europe.

L. FLEXICAULE, Hampe, of Europe, was collected by *Lyall* in the Cascade Mountains of Washington Territory. It is taller (1 to 3 inches), much branched and more densely cespitose, with long-subulate leaves from a lanceolate base: inflorescence dioœcious: capsule small, upon a very slender reddish pedicel; teeth unequal, slender and fragile: spores very minute. — *Trichostomum flexicaule*, Bruch & Schimp. Bryol. Eur. t. 180; Wilson, Bryol. Brit. 116, t. 42. *Cynodontium flexicaule*, Schwaegr. Suppl. i. 113, t. 29.

13. TRICHOSTOMUM, Smith.

Densely cespitose perennials, on the ground or rocks, fastigiately branched. Leaves in several ranks, larger and more crowded above, dull and papillose, costate, linear or lanceolate and mostly acuminate; areolation minute and hexagonal-quadrate above, looser and hyaline at base. Inflorescence diœcious or monœcious, terminal and bud-like. Calyptra cucullate, smooth. Capsule erect (in our species), long-pedicelled; operculum rostrate. Peristome single, of 16 teeth upon a narrow basal membrane, often imperfectly developed, equally 2-cleft to the base, but the filiform divisions rarely wholly free, erect when dry or sometimes more or less twisted to the right.

A genus variously limited; according to Schimper's definition embracing 17 European species, of which only the following are known to occur in North America.

1. **T. tophaceum,** Bridel. Stem erect and fastigiately branched, ½ to 1 inch high: leaves spreading, deep green, soft, the upper gradually enlarged, linear-lanceolate from an ovate base, obtuse or sometimes acute, minutely verrucose, the margins revolute, and costa ceasing below the apex: inflorescence diœcious: capsule upon a rather short reddish pedicel, ovate to oblong, reddish brown; operculum obliquely beaked; annulus none: teeth very variable, unequal and sometimes imperfect, the divisions somewhat coherent, pale or reddish.— Bruch & Schimp. Bryol. Eur. t. 175; Wilson, Bryol. Brit. t. 20; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 151.

In Cajon Pass (*Bigelow*); at Fort Point, and on wet limestone rocks near Ukiah City (*Bolander*); European.

2. **T. crispulum,** Bruch. Densely cespitose, slender: leaves much larger above, linear, twisted and involute when dry, very minutely papillose, mucronate with the shortly excurrent costa: flowers diœcious: capsule ovate or elliptic, irregularly sulcate when dry; annulus simple; operculum long-beaked: teeth unequally divided. — Regensb. Flora, xii, t. 4; Bruch & Schimp. l. c., t. 173.

Guadalupe Island (*Palmer*); Europe.

3. **T. anomalum,** Schimp. Stems loosely tufted, ½ to 2 inches high: leaves tufted and much larger above, linear, serrate at the apex, firm, somewhat twisted and incurved when dry: inflorescence monœcious, the male flowers solitary or clustered on short branchlets, with 6 to 9 perigonial leaves: capsule on a long flexuous reddish pedicel, long-cylindric: peristome upon a narrow rusty basal membrane, the long red-purple teeth twisted 2 or 3 times to the right. — *Barbula anomala,* Bruch & Schimp. l. c., t. 169. *T. corniculatum,* Schwaegr. Suppl. ii. 75, t. 118; Sulliv. in Pacif. R. Rep. iv. 185.

Collected near San Francisco (*Bigelow*), and in Oakland Cañon (*Bolander*); also by *Coulter,* but locality uncertain, and on Vancouver Island by *Lyall.*

4. **T. flexipes,** Bruch & Schimp. Stems 2 or 3 lines high, branching: leaves much larger above, linear, acuminate, serrate at the apex, with a white shining costa: inflorescence diœcious: capsule upon a straight or strongly flexuous pedicel, narrowly oblong, with a broad annulus: teeth of the peristome strict. — Bryol. Eur. t. 171. *T. crassinerve,* Hampe, Linnæa, xxx. 456.

Common on shaded ground and decaying trunks, from San Francisco to Mendocino County, *Bigelow, Bauer, Bolander.* Also European.

T. Coloradense, Austin, Coult. Bot. Gazette, ii. 90, is based upon specimens from Yosemite Valley without fruit, and the genus therefore undeterminable. The specific name is moreover a misnomer, as the plant is not known from Colorado. It is described as 2 or 3 lines high, with long-linear convolute leaves, with flat margins and incurved above, and a short remarkably slender costa.

14. DESMATODON, Bridel.

Closely allied to *Trichostomum*, from which it is separated by broader ovate- or obovate-oblong and usually obtuse or obtusish leaves; teeth of the peristome similar, rather short and subulate, somewhat incurved or loosely twisted when dry: low, soft, sparingly branched: inflorescence monœcious, the male flowers terminal and axillary: capsule erect in our species.

A small genus of five European species (four of which are also American), and five peculiar to North America.

1. **D. latifolius**, Bridel. Stems ½ to rarely 1 inch high: leaves deep green, paler with age, more or less spreading, incurved or somewhat twisted when dry, ovate-oblong, acuminate, carinate-concave with revolute margins, the costa excurrent or ceasing below the apex: capsule oblong-cylindric, brownish becoming chestnut-colored, covered to the base by the whitish calyptra; operculum with an oblique blunt beak: divisions of the teeth distinct or rarely somewhat connate, strongly papillose, pale red, incurved on drying. — Bruch & Schimp. Bryol. Eur. t. 129, 130; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 122. *Dicranum latifolium*, Hedw. Musc. Frond. i. 89, t. 33.

Var. **muticus**, Bridel. Stem taller, more slender and branched: leaves more obtuse: capsule deep purple.

Slopes of Tuolumne Cañon, and on Mount Dana at 11,000 feet altitude (*Bolander*); in Silver Valley, on exposed soil, at 8–9,000 feet altitude (*Brewer*); Cascade Mountains (*Lyall*); and from Arctic America to Utah, Colorado and Labrador. Also in alpine and subalpine Europe.

2. **D. systilius**, Bruch & Schimp. Leaves broader and softer, obovate-oblong, with flat margins, and minutely crenulate at the apex, the costa excurrent as a long seta: capsule narrower cylindric, yellow becoming red; operculum adherent to the columella: teeth smaller and less regular, partially coherent, paler. — Bryol. Eur. t. 131.

Foot of Mount Dana (*Bolander*); Rocky Mountains of British America (*Drummond*); also European.

D. CERNUUS, Bruch & Schimp. l. c., t. 134, distinguished from the preceding by the gibbous-ovate cernuous or subhorizontal capsule, has been collected in the East Humboldt Mountains, Nevada (*Watson*), and in British America. A European species.

15. BARBULA, Hedwig.

Closely allied to *Trichostomum*, from which it is distinguished by the usually very long distinct and filiform divisions of the teeth, which are more or less twisted to the left. — *Tortula*, Schreb.

The largest genus of the group, including over 100 species, Schimper referring to it a number that are usually placed in *Trichostomum* or *Desmatodon*. Mitten unites the three genera. The species in some of the groups seem to be needlessly multiplied.

§ 1. *Very low annuals, the rigid leaves with a broad thickened nerve covered above toward the apex with jointed filaments.* — ALOINA.

1. **B. rigida**, Schultz. Stems loosely cespitose, 1 or 2 lines long, scarcely branched: leaves dark green, spreading, oblong, obtuse, the membranous margin strongly inflexed: inflorescence dioœcious: capsule erect, elliptic-oblong, straight, half-covered by the long-beaked calyptra; operculum obliquely long-rostrate; annulus distinct: teeth rather long, twice twisted. — Recens. Barb. t. 32, fig. 1; Bruch & Schimp. Bryol. Eur. t. 137. *Tortula rigida*, Wilson, Bryol. Brit. t. 32.

Var. **pilifera**, Schimp. Upper leaves tipped with a hair-like awn as long as the blade. — DeNot. Musc. Ital. t. 4.

Collected (the variety) only on Guadalupe Island, *Palmer*. The species occurs through temperate and southern Europe, the variety in Italy and at the Cape of Good Hope.

§ 2. *Low perennials, with rather broad soft leaves: tubular base of the peristome short (except in* n. 11). — BARBULA.

* *Leaves thin and smooth, broadly ovate- or oblong-lanceolate, the costa produced into a hair-like awn, and bearing toward the apex of the leaf a dense cluster of green filaments.*

2. **B. membranifolia**, Schultz. Stems in dense hoary mats, ½ to 1 inch high, simple or branched: leaves erect-spreading, broadly ovate, strongly concave, the apex white-membranous and dentate, tipped by a very long hair: flowers monœcious, the male near the female, with 1 or 2 perigonial leaves: capsule erect upon a red pedicel, ovate-elliptic or narrowed and slightly incurved, brown or blackish, half-covered by the whitish calyptra; operculum narrow; annulus simple: teeth thrice twisted. — Bruch & Schimp. l. c., t. 140. *Tortula membranifolia*, Hook. Musc. Exot. i, t. 26.

Western Arizona, on Williams River, near the mouth of Santa Maria Creek (*Bigelow*), and reported by Schimper as from California; through Southern Europe and in the Caucasus.

3. **B. chloronotos**, Bruch. Smaller than the last, with smaller and narrower leaves, not white-membranous, and tipped with a shorter awn: flowers diœcious, the male flowers terminal and perigonial leaves many: capsule smaller, with compound annulus, and shorter twice twisted peristome. — Bryol. Eur. t. 141. *Tortula crassinervia*, DeNot. Musc. Ital. i. 23, t. 6.

Collected with the last by *Bigelow;* also European.

* * *Leaves oblong or ovate-oblong, papillose, mucronate, twisted or contorted when dry.*

+– *Divisions of the teeth unequal, becoming slightly twisted when damp.*

4. **B. atrovirens**, Schimp. Rather loosely matted, dull green, about 3 lines high: leaves crowded, spreading, ovate-oblong, shortly acuminate, concave, the margin narrowly revolute, the strong nerve thickened above and slightly excurrent or ceasing below the apex: male flowers bud-like at the base of the fertile branch: capsule oblong-elliptic, brown upon a yellowish pedicel; operculum obliquely beaked; annulus simple. — Syn. Musc. Eur. 2 ed. 194. *Grimmia atrovirens*, Engl. Bot. t. 2015. *Desmatodon nervosus*, Bruch. & Schimp. l. c., t. 132; Wilson, l. c., t. 20. *D. nervosus*, var. *edentulus*, Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 121. *D. Californicus*, Lesq. Mem. Calif. Acad. i. 10.

On the ground and old adobe walls near San Francisco (*Bolander*); Guadalupe Island (*Palmer*): throughout Europe, and ranging to the Cape of Good Hope.

5. **B. Guepini**, Schimp. l. c. 197. Lower leaves ovate-lanceolate, the upper ovate-oblong, strongly papillose, with reflexed margins, and awned by the excurrent costa: male flowers lateral, with 2 or 3 perigonial leaves: capsule oblong and subcylindric, brown, with a tall conical shortly beaked yellow operculum; annulus narrow. — *Desmatodon Guepini*, Bruch & Schimp. l. c., t. 133.

On the ground near Oakland, *Bolander*. Otherwise known only from France.

+– +– *Teeth of the peristome long and closely twisted.*

++ *Inflorescence monœcious.*

6. **B. cuneifolia**, Bridel. Stems densely clustered, 2 or 3 lines high, simple: lower leaves remote, broadly ovate, acuminate, the upper spreading-rosulate, oblong-ovate or spatulate, shortly acuminate, margin flat, the thin nerve ceasing below the apex or excurrent, all flaccid, loosely areolate and almost pellucid, crisped when dry: capsule elliptic-oblong, straight or nearly so; operculum narrowly conic, straight; annulus simple, narrow: peristome pale, upon a rather broad base. — Bruch & Schimp. l. c., t. 156. *Tortula cuneifolia*, Smith, Eng. Bot. t. 1510.

On clay soil near Oakland (*Bolander*); Western Europe. Variable in the form of its leaves.

7. **B. Vahliana,** Schultz. Resembling the last: leaves more oblong, opaque with a closer areolation above, the margins rarely reflexed, strongly crenulate, and costa always excurrent: capsule elongated, narrow; annulus broad, compound. — Recens. Barb. 222, t. 34, fig. 31; Bruch & Schimp. l. c., t. 157.

In the Coast Ranges, at Cajon Pass (*Bigelow*) and on Monte Diablo, *Bolander*. Also in Western Europe, rather rare.

++ ++ *Inflorescence dioecious.*

8. **B. marginata,** Bruch & Schimp. With the habit of the preceding: leaves oblong-lanceolate, obtuse or obtusish, mucronate with the excurrent costa, concave, the margin distinctly thickened: capsule oblong-cylindric, slightly curved, brown, with a rather broad simple annulus: teeth once twisted. — Bryol. Eur. t. 158. *Tortula marginata,* Wilson, Bryol. Brit. 131, t. 43.

On rocks near San Francisco (*Bigelow, Bolander*); Atlantic States; Europe and Northern Africa.

9. **B. Bolanderi,** Lesq. Stem short, simple or fasciculately branched: upper leaves densely rosulate and reflexed, ligulate or oblong, obtuse or shortly apiculate by the excurrent thick brown nerve, the areolation chlorophyllose above; inner perichætial leaves short: capsule dark red, cylindric, on a short reddish pedicel, with beaked operculum and short simple annulus: peristome reddish, twisted. — Trans. Amer. Phil. Soc. xiii. 5; Sulliv. & Lesq. l. c., 2 ed. n. 139.

On rocks near the bay of San Francisco (*Bolander*); Colorado, *Hall.*

10. **B. amplexa,** Lesq. l. c. Closely resembling the last: leaves softer and more loosely imbricated, longer, obtuse, and nerve not excurrent, the areolation pellucid; inner perichætial leaves elongated, erect, closely embracing the base of the pedicel: capsule shorter and smaller, pale green, with shorter obtuse operculum. — Sulliv. & Lesq. l. c., n. 140.

Near San Francisco, *Bolander, Gibbons.*

11. **B. brevipes,** Lesq. Stem very short, simple: leaves crowded, ligulate or oblong, obtuse and tipped by the slender excurrent costa, concave and the margin revolute, areolation above close and chlorophyllose: capsule long-cylindrical, slender and somewhat curved; operculum long-conic: peristome upon a long tubular membrane, closely twisted, red. — Mem. Calif. Acad. i. 12.

On mud walls at Mission Dolores, in mats an inch broad or more, and on Russian River divide (*Bolander*); near Carson City, and on rocks in the Trinity Mountains, Nevada, *Watson,* n. 1391.

§ 3. *Rather taller perennials, with lanceolate leaves (costa not excurrent or slightly so), and long peristome upon a very short basal membrane: flowers dioecious: perichatium more or less sheathing.* — TORTULA.

* *Leaves often brownish, nearly straight when dry. Species mostly closely allied.*

+– *Peristome several times twisted.*

12. **B. fallax,** Hedw. Cespitose, ½ to 1 inch high, brownish green: leaves squarrose, recurved-spreading, twisted when dry, lanceolate or linear-lanceolate, acuminate, carinate, the margin revolute and costa ceasing at the apex or slightly excurrent; areolation minute, uniform throughout: capsule narrowly ovate-oblong, slightly curved, brown upon a red pedicel, without annulus; operculum purple, subulate, as long as the capsule: peristome red, upon a very narrow base, very long, twisted closely. — Muse. Frond. ii. 66, t. 24; Bruch & Schimp. l. c., t. 147.

At Cajon Pass and near San Francisco, *Bigelow.* Also throughout Europe, very common, growing on the ground.

13. **B. subfallax,** Muell. Much like the last: leaves green, loosely imbricated, rather broadly ovate-lanceolate, with strongly revolute margins, the areolation at base more rectangular and pellucid than above, and the broad stout costa excurrent

in a short point; perichætial leaves strongly curved and margins revolute: capsule with simple persistent annulus, and loosely twisted peristome cleft to the base. — Bot. Zeit. xx. 338.

San Jose Valley, *J. Bauer.*

+– +– *Peristome once or twice twisted or less.*

14. **B. rigidula,** Schimp. Closely resembling *B. fallax,* but growing on rocks and stones, with a firmer capsule, narrow annulus, and the teeth of the peristome shorter and scarcely at all twisted. — Syn. Musc. 2 ed. 206. *Didymodon rigidulum,* Hedw. Musc. Frond. iii. 8, t. 4. *Trichostomum rigidulum,* Smith; Bruch & Schimp. l. c., t. 176; Wilson, l. c., t. 20.

On rocks subject to overflow on Russian River, opposite Ukiah (*Bolander*); Vancouver Island (*Lyall*); European.

15. **B. semitorta,** Sulliv. Stems loosely cespitose, 3 or 4 lines high, subsimple, rooting at base: leaves crowded above, spreading horizontally from an erect clasping base, linear-lanceolate, concave with flat margins and the firm costa ceasing at the apex: capsule cylindrical, with slender beaked operculum scarcely covered by the calyptra, narrow annulus, and rather long peristome twisted half-way round. — Pacif. R. Rep. iv. 186, t. 3.

Near Benicia, *Bigelow.*

16. **B. brachyphylla,** Sulliv. Stems densely cespitose, 8 to 12 lines high, fastigiately branched, rooting the whole length: leaves dark brownish green, firm and thick, spreading, ovate, shortly and obtusely acuminate, stoutly costate to the apex and the margins recurved; areolation minute, uniform: capsule cylindrical, with obliquely beaked operculum more than covered by the calyptra, a simple annulus, and the peristome twisted scarcely half-way round. — Pacif. R. Rep. iv. 186, t. 2.

Near Benicia, with the last, *Bigelow.*

17. **B. purpurea,** Muell. Stems very short, forming small very rigid purple mats: leaves few, firm, shortly lanceolate from an oblong base, concave, with strongly revolute margins and stout excurrent costa: capsule minute, elliptical, with conical operculum as long as the capsule, a narrow persistent annulus, and scarcely twisted elongated peristome: calyptra reaching the base of the capsule. — Flora, lviii. 78 (1875).

With *B. virescens,* upon rocks near Oakland, *Bolander.*

18. **B. vinealis,** Bridel. More densely cespitose and less brown than *B. fallax,* with more crowded longer and more acuminate leaves, somewhat flaccid and crisped when dry, the margins less revolute and nearly flat above: capsule thicker and more elliptical, with shorter operculum, a rather broad double annulus, and a shorter nearly white peristome upon a broader basilar membrane, twisted once or 1½ times. — Bruch & Schimp. l. c., t. 148; Sulliv. & Lesq. l. c., n. 90^{b} (2 ed. n. 130, 131).

Around San Francisco, on rocks and stones near the bay, very common and variable (*Bolander*); Oakland and Sonora, *Bigelow.* Common also in Europe. Some of the following species are scarcely distinct.

19. **B. artocarpa,** Lesq. Densely cespitose: stems slender, short, subsimple: lower leaves short, lanceolate from an ovate base or short-subulate, the stout costa running to the apex; the upper longer and more narrowly lanceolate-subulate; perichætial leaves broader, clasping at base, crowded above, erect; areolation at base looser and chlorophyllose: capsule ovate-cylindrical, short, slender, contracted at the mouth, with a long-beaked curved operculum and broad simple persistent annulus: teeth slender, whitish, once twisted. — Trans. Amer. Phil. Soc. xiii. 4; Sulliv. & Lesq. l. c., n. 133.

On Monte Diablo, and northward to Ukiah, *Bolander.*

20. **B. flexifolia**, Hampe. Distinguished from the last by the more revolute leaves, squarrose-reflexed when wet, crisped when dry, the dark red capsule somewhat narrower and with a longer operculum, and by the longer red and more twisted peristome. — Linnæa, xxx. 456; Lesq. l. c.; Sulliv. & Lesq. l. c., n. 132.

On sand and boulders, near San Francisco, with the last, *Bolander*, *Bauer*.

21. **B. virescens**, Lesq. l. c. Intermediate between the last and *B. semitorta*, distinguished from the one by the much looser distinct oval areolation, and from *B. semitorta* by the longer leaves with margins revolute to the apex, and by the longer and more twisted peristome upon a broader basilar membrane. — Sulliv. & Lesq. l. c., n. 134.

On rocks at Redwood and Oakland, *Bolander*.

22. **B. Beecheyi**, Lesq. Ms. Stems stout, subcespitose, branching, ½ to 1 inch high, brownish yellow: leaves loosely imbricated, open-erect, or appressed and slightly tortuous when dry, ovate-lanceolate with revolute margins and strong excurrent costa: capsule large, oblong, reddish, on a straight reddish pedicel a half-inch long, with erect pointed operculum half as long as the capsule, and a double white annulus: peristome red, twice twisted, on a short membrane. — *B. insulana*, DeNot. (*t*); Lesq. Mem. Calif. Acad. i. 11; Mitten, Journ. Linn. Soc. viii. 27.

On gravelly soil, near the Big Trees (*Bolander*); also collected by *Capt. Beechey*.

* * *Leaves bright green or yellowish, twisted and incurved when dry: peristome very long, purple, strongly twisted.*

23. **B. convoluta**, Hedw. Small and slender, in broad flat mats, bright green above: leaves narrowly lanceolate, acute, with flat margins above the base, and costa ceasing at or below the apex; perichætial leaves sheathing, the inner convolute, blunt, nerveless: capsule narrowly oblong, incurved, upon a long yellow pedicel, with conic-subulate operculum and rather broad annulus. — Musc. Frond. i. 86, t. 32; Bruch & Schimp. l. c., t. 154; Fl. Dan. xv, t. 2614, fig. 2.

Oakland (*Bigelow*); in gardens at San Francisco, and on burnt logs at Ukiah, *Bolander*. Also in the Alleghanies and throughout Europe.

§ 4. *Usually somewhat taller: leaves oblong to obovate-spatulate, smooth and hyaline at base, papillose and more closely areolate above: capsule usually arcuate, erect on a stout pedicel: peristome upon a long basal tube, much twisted.* — SYNTRICHIA.

* *Leaves acute or blunt, and costa slightly excurrent, crowded above: capsule very slender: monœcious.*

24. **B. subulata**, Bridel. Stems usually short (3 lines to an inch high), loosely cespitose, simple or branched, rooting at base: leaves obovate- and oblong-spatulate, entire or serrate at the apex, with flat margins and sometimes a yellow border: capsule elongated, cylindrical, brown, on a twisted pedicel, with narrowly conic operculum, double annulus, and peristome pale red, tubular half its length or more. — Bruch & Schimp. l. c., t. 160. *Tortula subulata*, Hedw. Spec. Musc. t. 37; Engl. Bot. t. 1101.

Big Tree Grove (*Bolander*); Western Arizona (*Bigelow*); Wahsatch Mountains (*Watson*); in British America from the Rocky Mountains to Canada, and through most of Europe.

25. **B. inermis**, Bruch. Leaves firmer than the last, the lower oblong-lanceolate, the upper long-linear, blunt or very shortly apiculate, with appressed-reflexed margins and no border, minutely papillose both sides, olive or yellowish: capsule more narrowly cylindrical. — Bruch & Schimp. l. c., t. 161 (var. γ), and t. 167. *Tortula inermis*, Mont.; DeNot. Musc. Ital. i. 44, t. 20.

Base of mountains west of the Colorado River (*Bigelow*), and collected also by *Bolander*. Southern Europe.

* * *Leaves emarginate or rounded at the apex, the costa usually excurrent as a hair: capsule oblong-cylindric.*

\+ *Flowers monœcious.*

26. **B. lævipila,** Bridel. Densely matted, tomentose at base: leaves spreading or recurved, deep or glaucous green becoming brown, oblong or obovate-oblong, rounded and emarginate above, the terminal white seta smooth or serrate: capsule oblong-cylindrical, deep brown, with slender conical operculum, and peristome tubular for one-third its length. — Bruch & Schimp. l. c., t. 164; Sulliv. & Lesq. l. c., 2 ed. n. 143. *Tortula lævipila,* Schwaegr. Suppl. t. 120; Wilson, l. c., t. 43.

On railroad levees at Sacramento and on Monte Diablo (*Bolander*); on the Pah-Ute Mountains, Nevada (*Watson*); Vancouver Island (*Lyall*); also all temperate and Southern Europe, and Northern Africa.

\+ \+ *Flowers diœcious.*

27. **B. latifolia,** Bruch. In loose soft patches, ½ to 1 inch high, deep or lurid green: leaves less crowded below, the upper rosulate and spreading, obovate-spatulate, obtuse and emarginate, the costa scarcely excurrent: capsule oblong-cylindrical, on a rather short pedicel, brown, with narrow simple annulus, and peristome as in the last. — Bruch & Schimp. l. c., t. 164; Sulliv. & Lesq. l. c., n. 144. *Tortula latifolia,* Wilson, Bryol. Brit. t. 43.

Borders of a creek near San Rafael (*Bolander*); Oregon, *Hall.* European.

28. **B. ruralis,** Hedw. In broad loose yellowish mats, 1 to 3 inches high: leaves squarrose-recurved, oblong, margins reflexed, the apex rounded or emarginate, with a white long and flexuose rough spinulose seta: capsule oblong, subcylindrical, reddish brown, long-pedicellate, with double annulus, and purple peristome tubular a half or one-third its length. — Bruch & Schimp. l. c., t. 166. *Tortula ruralis,* Schwaegr. Suppl. t. 34; Berkeley, Brit. Moss. t. 22, fig. 4.

Var. **gigantea,** Lesq. Stem elongated, the leaves squarrose-reflexed from the base, with long forked papillæ; costa spinulose-rugose on the back. — Mem. Calif. Acad. i. 13; Sulliv. & Lesq. l. c. n. 146.

Very common on rocks and trunks of trees, from the plains to the mountains (*Bigelow, Bolander, Brewer*); Oregon; Nevada and Utah; Texas; and from Arctic America to the Eastern States, and common throughout Europe. The variety on moist rocks in Yosemite Valley, *Bolander.*

\+ \+ \+ *Flowers bisexual.*

29. **B. Muelleri,** Bruch & Schimp. Stems in dense olive- or brownish-green mats, 1 or 2 inches high, densely leafy, branched, radiculose to the top: leaves erect-spreading, folded and appressed when dry, broadly oblong, obtuse, the red costa excurrent as a long obsoletely spinulose hair, margins subrevolute below: capsule cylindrical, long-pedicellate, firm, brown, with double annulus. — Bryol. Eur. t. 168; Sulliv. & Lesq. l. c., n. 100[b] (2 ed. n. 147). *Tortula Muelleri,* Wilson, l. c., t. 44. *T. princeps,* DeNot. Musc. Ital. i. 33, t. 13.

Common, especially in the plains (*Bigelow, Bolander, Brewer*); Carson City (*Watson*); Vancouver Island (*Lyall*); also in Chili, and through Western Europe.

16. FISSIDENS, Hedw.

Stems simple or sparingly branched. Leaves strictly 2-ranked, infolded boat-shaped at base and produced above into an equitant vertical blade costate to the apex; areolation minute, round-hexagonal, chlorophyllose. Inflorescence various, bud-like, terminal or axillary. Calyptra cucullate or rarely mitriform. Capsule rather long-pedicellate and usually nodding, oval or oblong, straight or slightly incurved; operculum large, beaked; annulus narrow. Peristome simple, of 16

unequally cleft teeth, as in *Dicranum*, the narrow segments with numerous prominent joints, and geniculately inflexed when dry.

A genus readily recognized by its very peculiar foliage, of about 20 European species and nearly as many American, 5 species being common to both regions.

* *Fruit terminal: very small.*

1. **F. limbatus,** Sulliv. Small, the stems 2 or 3 lines high, simple or sparingly branched below: leaves 8 to 10 pairs, oblong, hyaline upon the margin except at the apex, the acute blade scarcely equalling the broadly margined complicate base: inflorescence monœcious; perigonial leaves broadly ovate, entire, with nearly obsolete blade: capsule oblong, somewhat cernuous, upon a comparatively long pedicel: teeth of the peristome almost wholly inflexed within the capsule. — Pacif. R. Rep. iv. 185, t. 1.

On shaded ground near Oakland, and common around San Francisco, *Bigelow, Bolander.*

2. **F. ventricosus,** Lesq. Stouter, loosely cespitose, dark colored; the stems an inch long or more, branching from the base, the branches simple or sparingly divided, with rootlets at all the nodes: leaves numerous, crowded, erect-spreading, coulter-shaped, with dilated ventricose base, obtusish, with a thick costa, and generally surrounded by a thick margin; areolation ovate-quadrate or irregularly polygonal; involucral leaves broadly ovate, irregularly dissected, apiculate: inflorescence monœcious: capsule obovate, erect upon a very short scarcely exserted pedicel, attenuate at base; teeth erect, rather broad. — Mem. Calif. Acad. i. 7; Sulliv. Icon. Musc. Suppl. 45, t. 30.

On submerged rocks, Mendocino City, *Bolander.* Only a single capsule was collected, without operculum.

* * *Fruit axillary: plants larger.*

3. **F. grandifrons,** Bridel. Stems erect, 2 or 3 inches high, simple or sparingly branched, rather rigid, green: leaves numerous, crowded or somewhat remote, linear-lanceolate, acuminate, thick and rigid, formed of several layers of cells, the stout costa ceasing below the apex: inflorescence diœcious, the female flower bud-like and axillary, containing numerous archegonia; male flower and capsule unknown. — Bruch & Schimp. Bryol. Eur. t. 106.

Near the sea, Mattole district, Humboldt County, on rocks constantly wet with spring water, *Bolander.* Also found at Niagara Falls, and upon wet rocks in Mexico, Europe, Algiers, and the mountains of India.

F. ADIANTOIDES, Hedw., is a more common species in the Atlantic States and throughout Europe, on shaded moist ground and wet rocks, and was collected by *Lyall* at Fort Colville. The much branched stems are 1 to 3 inches high, with oblong-lanceolate acuminate serrulate leaves hyaline upon the margin, the costa excurrent: inflorescence monœcious, axillary; pedicel from the middle of the stem: capsule nodding: operculum long-beaked: teeth bright purple. — Bruch & Schimp. l. c., t. 105.

17. DISTICHIUM, Bruch & Schimp.

Densely cespitose alpine perennials, on wet rocks, dichotomously branched. Leaves distichous, spreading from a clasping base, subulate-setaceous, costate, entire or nearly so, smooth and shining; areolation minutely quadrate above, looser and hyaline at base. Inflorescence monœcious; antheridia long and slender. Calyptra cucullate, long-beaked. Capsule erect or nodding, long-pedicellate, oblong or cylindrical, coriaceous, shining, annulate; operculum conic. Peristome single, of 16 linear-lanceolate teeth, subentire or bifid, with a submedial line, punctulate, reddish.

Including 2 species, both widely distributed.

1. **D. capillaceum**, Bruch & Schimp. Tufts dense, silky green above, ferruginous below, rufous-tomentose, 1 or 2 inches high: leaves spreading, flexuous, abruptly long-subulate from a dilated somewhat sheathing base, with excurrent costa, entire: antheridia naked in the upper axils: capsule erect on the reddish pedicel, oblong-cylindrical, regular or somewhat curved: teeth narrow. — Bryol. Eur. t. 193; Sulliv. in Gray's Manual, 2 ed. t. 2; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 108 (2 ed. n. 161); Berkeley, Brit. Moss. t. 22, fig. 7. *Swartzia capillacea*, Hedw. Musc. Frond. ii. 72, t. 26.

In the Yosemite Valley, on shelving rocks between Vernal and Nevada Falls (*Bolander*); in the Cascade Mountains (*Lyall*); East Humboldt Mountains, Nevada (*Watson*); and from the Arctic regions to Colorado, Lake Superior and the White Mountains. Also in the mountains of Europe, Asia, Africa and South America.

2. **D. inclinatum**, Bruch & Schimp. Tufts soft, dull olive-green, darker below than the last, ½ to 1 inch high: leaves narrower, densely crowded, minutely serrate at the apex: male flowers with 2 or 3 perigonial leaves: capsule oval, nodding: teeth broader, purple. — Bryol. Eur. t. 194; Fl. Dan. t. 2687; Sulliv. & Lesq. l. c., n. 108[b] (2 ed. n. 162). *Swartzia inclinata*, Hedw. l. c. ii. 74, t. 27.

At Soda Springs, near head of the Tuolumne (*Bolander*); Uinta Mountains (*Watson*); and from the Arctic regions to Lake Superior and Newfoundland. Also in the mountains of Europe; rarer than the last.

18. HEDWIGIA, Ehrh.

Stem branched, rooting at base. Leaves in 8 ranks, oblong-lanceolate, subcoriaceous, densely papillose-hirsute on the back, erose and ciliate at the hyaline apex, nerveless; areolation very minute, quadrate and rectangular, at the middle of the base long-linear. Flowers monœcious, bud-like. Calyptra conic-mitriform, entire at base, hairy or naked, covering only the broad convex or umbonate operculum, very fugacious. Capsule globose, immersed, very shortly pedicellate, erect, without annulus or peristome.

A single species; growing on rocks.

1. **H. ciliata**, Ehrh. Stems 1 to 4 inches high, dichotomously or irregularly branched, loosely cespitose, pale glaucous-green: leaves spreading or secund, concave: capsule pale brown with a reddish mouth. — Hedw. Musc. Frond. t. 40; Bruch & Schimp. Bryol. Eur. t. 272, 273; Wilson, Bryol. Brit. t. 6; Sulliv. in Gray's Man. 2 ed. t. 2; Berkeley, Brit. Moss. t. 21, fig. 8.

Reported as found on redwood stumps (*Bolander*); cliffs of Williams River, Arizona (*Bigelow*); British Columbia (*Lyall*); very common in the Atlantic States and throughout Europe.

19. BRAUNIA, Bruch & Schimp.

Stems broadly cespitose, irregularly branched, stoloniferous. Leaves in 8 ranks, ovate-lanceolate, rather firm, smoothish, nerveless, the areolation rectangular, long-linear at the middle of the base. Flowers monœcious or bisexual, bud-like. Calyptra cucullate, smooth, long-beaked, nearly or quite covering the capsule. Capsule subglobose to long-elliptic, exserted upon a long pedicel, with conic obtuse operculum, without annulus or peristome.

A small genus, too near the last and differing from it chiefly in its cucullate calyptra and exserted capsule. The only American species is the following, referred to *Hedwigia* by Mitten.

1. **B. Californica**, Lesq. Loosely cespitose, yellowish green becoming brown, the straight hard stems erect and simple or with short irregular branches: leaves oblong-ovate, hyaline and sometimes setose at the acuminate apex, with reflexed or revolute margins: calyptra mitriform, at length conic-cucullate: capsule turbinate,

smooth, at length plicate, light brown, upon a slender pedicel 3 to 6 lines long; operculum long-conic. — Trans. Amer. Phil. Soc. xiii. 8, and Mem. Calif. Acad. i. 15; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 226; Sulliv. Icon. Musc. Suppl. 41, t. 27. *Hedwigia pilifera*, Mitten, Journ. Linn. Soc. viii. 45, t. 7.

On Monte Diablo (*Bolander*); Vancouver Island, *Lyall.*

20. ZYGODON, Hook. & Tayl.

Low tufted or matted perennials, fastigiately branched, on trees or rocks. Leaves soft, dull, in 5 or 8 ranks, squarrose-spreading, linear- to oblong-lanceolate, carinate, with flat margins, and costate usually to the apex, the areolation minutely quadrate above, loose and more rectangular at the hyaline base. Flowers monœcious or dioœcious, bud-like, terminal or the male axillary. Calyptra cucullate, smooth. Capsule erect, immersed or exserted, ovate-oblong, 8-striate, with rather long obconic collum, minute obliquely rostrate operculum, and no annulus. Peristome none (in our species), or present and as in *Orthotrichum.*

About 60 species are known, widely distributed, but most abundant in the mountains of South America. Closely allied to *Orthotrichum.* Schimper separates the group to which the following species belong, forming a genus *Amphoridium*, simply on the urceolate shape of the dry capsule.

1. **Z. Lapponicus**, Bruch & Schimp. Stems ½ to 1 inch high, fragile, tomentose with rhizoids: leaves linear-lanceolate, costate nearly to the apex, crisped and twisted when dry, yellowish green becoming brown and black; perichætial leaves ovate-lanceolate, sheathing: flowers monœcious, the male often clustered: capsule scarcely exserted, ovate, constricted below the broad orifice when dry: calyptra brownish, covering the short-beaked operculum. — Bryol. Eur. t. 206; Wilson, Bryol. Brit. t. 6; Sulliv. in Gray's Man. 2 ed. t. 2; Berkeley, Brit. Moss. t. 20, fig. 3; *Gymnostomum Lapponicum*, Hedw. Musc. Frond. iii. 10, t. 5.

Yosemite Valley, in spray of the Nevada Fall (*Bolander*); Cascade Mountains (*Lyall*); also in the Alleghanies, and in the alpine regions of Europe.

2. **Z. Californicus**, Hampe. A similar species, loosely matted, dull green: leaves very much crisped, loosely spreading and flexuose when wet, with the costa excurrent and margins narrowly revolute below and remotely denticulate above; perichætial leaves not sheathing, much narrower and acuter, with slightly revolute margins: capsule shortly exserted on a very slender purplish pedicel. — Muell. in Bot. Zeit. xx. 361; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 172; Sulliv. Icon. Musc. Suppl. 47, t. 32.

In San Jose Valley, *J. Bauer.*

21. TETRAPHIS, Hedw.

Densely cespitose perennials, on rocks or decaying wood, erect, innovating at base and summit. Leaves mostly 3-ranked, the upper much the larger, crowded, smooth, broadly ovate-lanceolate, entire, costate to below the apex; areolation rounded hexagonal, looser and linear-rectangular at base. Inflorescence monœcious, terminal, bud-like. Calyptra mitriform, naked, irregularly sulcate, with firm rough apex and thin lobed base, covering the capsule to the middle. Capsule cylindrical, erect, long-pedicellate, thin, with thin long-conic operculum and no annulus. Peristome of 4 rigid brown broadly lanceolate triquetrous teeth, formed from the 4-cleft internal tissue of the operculum, sulcate on the back.

A genus of two species, one of Europe and North America, the other of Japan.

1. **T. pellucida**, Hedw. Stems ½ to 1 inch high, light green above, reddish below, with numerous rhizoids at base, often bearing at the summit a cup-shaped

cluster of very broad leaves filled with long-pedicelled lentiform gemmæ: female flowers also sometimes gemmiferous: capsules yellowish brown, sometimes in pairs. — Spec. Musc. t. 7, fig. 1; Bruch & Schimp. Bryol. Eur. t. 196; Wilson, Bryol. Brit. t. 8; Sulliv. in Gray's Manual, 2 ed. t. 2; Berkeley, Brit. Moss. t. 19, fig. 8.

On redwood logs near Big River City (*Bolander*); Fort Colville (*Lyall*); frequent in the Atlantic States, and throughout most of the northern hemisphere.

22. GRIMMIA, Ehrh.

Perennials, growing on rocks, usually in dense tufts or cushions, dichotomously branched. Leaves dull, in 5 to 8 ranks, the lower often smaller, crowded, spreading, lanceolate, the costa usually long-excurrent, mostly entire with narrowly thickened margins, minutely papillose; areolation quadrate or hexagonal above, at base rectangular or linear or sinuous. Flowers monœcious or diœcious, bud-like, terminal. Calyptra usually mitriform and lobed or cleft at base, sometimes cucullate, not sulcate, naked and smooth. Capsule usually erect, with simple or compound annulus, and simple purple peristome of 16 lanceolate flat-jointed cribrose teeth, entire or more or less deeply 2 – 3-cleft.

A genus of nearly 100 species, represented in Europe by about 40 species, and in the United States by 25, of which 15 are also European.

§ 1. *Capsule depressed-spherical, immersed, erect: calyptra large, cucullate: operculum flat, persistent on the columella: leaves not setosely tipped.* — Scouleria. (*Scouleria*, Hook.)

1. **G. Scouleri**, Muell. Aquatic: stems loosely cespitose, dichotomously branched, 3 to 5 inches long, flexuose, black: leaves firm, crowded, recurved, broadly lanceolate, dark green, carinate, serrate, minutely punctate, the margin thickened: calyptra brown, obtusish: capsule very shortly pedicelled, deep brown, shining, somewhat flattened, at length much depressed; operculum umbonate: peristome reddish yellow, reflexed, the short teeth more or less bifid at the apex. — Syn. ii. 654. *Scouleria aquatica*, Hook. Bot. Misc. i. 33, t. 18; Schwaegr. Suppl. t. 315.

On rocks in Merced River near Clark's (*Bolander*); in Columbia River (*Drummond, Lyall*); Observatory Inlet, in running water, *Scouler.*

§ 2. *Capsule ovate or subglobose, immersed on a short erect pedicel: calyptra mitriform, not reaching the edge of the depressed very shortly rostellate operculum, which falls away with the columella: only the upper leaves setosely tipped.* — Schistidium.

2. **G. conferta**, Funk. In compact tufts, deep green above, blackish below: leaves ovate- or oblong-lanceolate, the margin reflexed below and slightly thickened above; seta remotely denticulate: calyptra minute, 5-lobed at base: capsule ovate-globose, brown, thin, with acutely apiculate operculum, and a deep orange peristome, the teeth short-lanceolate, subentire and much perforated. — *Schistidium confertum*, Bruch & Schimp. Bryol. Eur. t. 232.

On Monte Diablo (*Bolander*); in cañons near Green Valley (*Brewer*); West Humboldt Mountains, Nevada, and the Uintas (*Watson*); northern Atlantic States, Europe, and Abyssinia.

3. **G. apocarpa**, Hedw. More loosely tufted, ½ to 1 inch high or more: leaves spreading, erect when dry, lanceolate, with appressed-recurved margins, toothed at the apex; areolation toward the base narrow and sinuous; perichætial leaves broader and thinner: capsule larger, ovate, firmer and opaque, red, long-apiculate: teeth larger, deep purple, sometimes perforated, widely spreading when dry. — *Schistidium apocarpum*, Bruch & Schimp. l. c., t. 233, 234; Wilson, Bryol. Brit. t. 13; Sulliv. in Gray's Man. 2 ed. t. 2.

Yosemite Valley (*Bolander*); Colorado River (*Bigelow*); Uinta Mountains (*Watson*); common eastward, from Arctic America to the Atlantic States, and in most quarters of the globe. An exceedingly variable species. Var. *rivularis*, Nees & Hornsch., a large form, 2 or 3 inches high, with ovate-lanceolate obtusish leaves, and shorter capsule becoming turbinate, is found on wet rocks in Yosemite Valley, *Bolander*.

§ 3. *Capsule more or less exserted upon an arcuate pedicel: calyptra larger, mostly mitriform and lobed at base: operculum conic, obtuse or rostrate, deciduous without the columella: leaves all setosely tipped.* — GRIMMIA proper.

* *Calyptra campanulate-cucullate: flowers monœcious.*

4. **G. Jamesii**, Austin. In compact hemispherical tufts: leaves crowded above, erect when dry, oblong- to ovate-lanceolate, convolute-concave above the middle, tipped with a white scabrous subulate-liliform seta, the costa reaching to the apex, areolation at the angles enlarged-quadrate: calyptra large, unequally lobed at base: capsule round-oval, slightly exserted upon a slender yellow pedicel, from yellow becoming red, obconic when dry and slightly striate; operculum very shortly convex-acuminate; annulus obscure: teeth pale red, very short, broad, 3 – 4-cleft, and much perforated below. — Torr. Bot. Bull. vi. 43. *G. orbicularis*, James, Bot. King Exp. 403, not Bruch & Schimp.

On dry rocks near Carson City, *Watson*. With the strongly cribrose peristome of *Coscinodon*, but the calyptra cucullate and not plicate.

* * *Calyptra mitriform and lobed, straight or oblique.*

+ *Flowers monœcious.*

5. **G. pulvinata**, Smith. Resembling the last, but less crowded and somewhat paler, ½ to 1 inch high: leaves oblong-lanceolate, the margin slightly thickened: capsule upon a longer pedicel, distinctly striate, costate when dry, firmer, brown; operculum convex, rostrate; annulus broader: teeth bright purple, longer, sparingly perforated, unequally bifid. — Engl. Bot. t. 1728; Bruch & Schimp. l. c., t. 239; Wilson, l. c., t. 13; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 137[b].

Near Ukiah, on Russian River, and about Clear Lake (*Bolander*); on William's River, Arizona (*Bigelow*); Hot Spring Mountains, Nevada, and the Uintas (*Watson*); Fort Colville (*Lyall*); Arctic America (*Taylor*); and widely distributed through the Old World.

+ + *Flowers diœcious.*

6. **G. contorta**, Schimp. Rounded tufts soft, deep green, blackish below: leaves spreading-incurved, crisped when dry, lanceolate to linear-subulate, hyaline at the apex or shortly setose, somewhat folded-carinate, the margin recurved below; perichætial leaves 8 or 9, subulate, spreading: capsule nodding upon a somewhat arcuate pedicel, erect when dry, oval, soft, yellowish, small: operculum convex-conic, obtuse: annulus broad: teeth orange-red, reflexed when dry, bifid to below the middle and perforated. — *G. uncinata*, Kaulf.; Bruch & Schimp. l. c., t. 248. *G. incurva*, Schwaegr. Suppl. ii. t. 97.

Big Tree Grove (*Bolander*); alpine regions of Europe.

7. **G. Muhlenbeckii**, Schimp. Loosely tufted, soft, from green becoming hoary; stems tall, branching: leaves densely crowded, erect when dry, long-lanceolate, channelled along the very prominent costa, carinate at the apex, with flat margins, the upper leaves tipped with a rather long very rough hair: capsule exserted upon an arcuate pedicel, somewhat pendulous, oval, smooth, brownish, with a convex apiculate operculum and narrow annulus: teeth reddish purple, erect when dry, entire, rarely slightly bifid. — *G. incurva*, Bruch & Schimp. l. c., t. 243.

Mount Dana, at 10,500 feet altitude (*Bolander*); Alps of Europe.

8. **G. trichophylla**, Grev. Loosely tufted, soft, yellowish or green; stems ¼ to 1 inch long: leaves spreading, incurved when dry, oblong-lanceolate, attenuate to

a long somewhat hispid hair, carinate-concave, the margin at base recurved : capsule upon a strongly curved pedicel, ovate or oblong, 8-costate, pale brown ; operculum red, straight-beaked ; annulus broad, compound : teeth irregularly bifid to the middle or simply lanceolate-subulate, red, convergent when damp, erect-spreading when dry. — Bruch & Schimp. l. c., t. 244 ; Wilson, l. c., t. 32 ; Sulliv. & Lesq. Muse. Am.-Bor. Exsicc. 2 ed. n. 207.

Var. **meridionalis**, Schimp. More densely tufted, stems slender, tall, dark brown below : leaves shorter, arcuately recurved when damp : capsule smaller, subglobose, less sulcate, red : teeth smaller. — *G. ancistrodes*, Mont. *G. Californica*, var., Sulliv. in Pacif. R. Rep. iv. 187, t. 4, fig. 1ᵇ – 3ᵇ.

Near Oakland and elsewhere, common (*Bigelow, Bolander*) ; the variety in Dardanelles Cañon (*Bolander*) ; Europe and Northern Africa.

9. **G. Californica**, Sulliv. Loosely cespitose, about ½ inch high : leaves erect-spreading, long-lanceolate, carinate, concave with revolute margin, costa excurrent into a hyaline denticulate hair : calyptra cucullate-mitriform, 4 – 5-cleft at base : capsule oval or oblong, with an evident collum, pendulous upon a short arcuate pedicel, scarcely costate when dry ; operculum with a long straight beak ; annulus rather broad, compound : teeth bifid nearly to the middle. — Pacif. R. Rep. iv. 187, t. 4, excl. var. ; Sulliv. & Lesq. l. c., n. 205, 206.

On rocks at San Rafael and around San Francisco, common, *Bigelow, Bolander*. With it is found a variety with the obtusish or acute leaves not setose, and the capsule subglobose, with a longer operculum.

10. **G. hamulosa**, Lesq. Loosely tufted, blackish : leaves somewhat fascicled, falcate-secund when dry, erect and curved inward like a hook when moist, loosely imbricated, narrowly lanceolate-subulate, carinate-concave with nearly flat margin, the stout nerve ceasing below the obtusish opaque apex : capsule upon a somewhat curved pedicel, oval, smooth, brown, with a short conic operculum and no annulus : teeth rather short, lacerate or imperfectly divided. — Mem. Calif. Acad. i. 14.

On gravelly soil upon Mount Dana, at 10,000 feet altitude, *Bolander*.

§ 4. *Capsule upon a straight erect pedicel, mostly exserted, not ribbed ; columella not deciduous : leaves spreading, not crisped, mostly setose, with flat margins ; areolation rectangular at base, rarely sinuous.* — GUEMBELIA.

* *Calyptra mitriform, lobed at base.*

+– *Flowers monœcious.*

11. **G. ovata**, Web. & Mohr. Rather stout, tufted, ½ inch high or more, green turning gray : leaves lanceolate from an oblong concave base, with reflexed margins, acutely carinate, attenuate into a rather long smoothish hair, slightly thickened on the margin : capsule exserted, ovate to oblong, firm, becoming brown, with obliquely beaked or rarely obtuse operculum and broad annulus : teeth rather long, purple, unequally cleft to the middle or lacerate and cribrose, spreading when dry. — Schwaegr. Suppl. i, t. 24 ; Bruch & Schimp. Bryol. Eur. t. 254.

On dry rocks in the Truckee and West Humboldt Mountains, Nevada (*Watson*) ; Arctic America to Lake Superior ; Europe, Asia, and the Sandwich Islands. Variable.

+– +– *Flowers diœcious.*

12. **G. leucophæa**, Grev. Broadly cespitose, silvery gray : leaves dark green, long-lanceolate from an oblong base, terminated by a long very hispid hair, spreading, with slender costa and thin margin : capsule rarely exserted, elliptic or broad-oblong, brown, contracted at the mouth, with a conic-subulate or bluntly beaked operculum and broad annulus : teeth usually 2 – 3-cleft to the middle, cribrose below, purple, spreading when dry. — Scot. Crypt. Fl. t. 284 ; Bruch & Schimp. l. c., t. 257.

Dry rocks, Dardanelles Cañon (*Bolander*) ; East Humboldt Mountains, Nevada (*Watson*) ; Fort Colville (*Lyall*) ; Northern Atlantic States, Europe, Africa, and Australia.

13. **G. calyptrata,** Hook. Densely tufted, canescent: leaves somewhat crowded, erect and subappressed, oblong-lanceolate, somewhat folded-carinate, margin scarcely recurved, the upper with a long smoothish hair; perichætial leaves longer and broader: capsule on a slightly exserted pedicel, cylindric-oblong, brown, wholly covered by the calyptra: operculum conic-rostrate; annulus narrow: teeth purple, bifid. — Drum. Musc. Am. n. 60. *Guembelia calyptrata,* Muell. Musc. Fround. i. 775.

On dry rocks near Carson City (*Watson*); in the Rocky Mountains from British America (*Drummond*) to New Mexico.

* * *Calyptra cucullate, lobed at base: diœcious.*

14. **G. elongata,** Kaulf. Stems erect, very slender, naked at base, several times branched, forming tumid blackened tufts: leaves rather firm, the lower lanceolate and blunt, the upper lanceolate from an ovate-oblong base, the apex hyaline or shortly setose, carinate-concave, the margin slightly thickened above: calyptra oblique, long-beaked, 5-lobed: capsule minute, exserted, elliptic, yellowish, with short obtuse operculum and narrow annulus: teeth subentire, reflexed on drying. — Bruch & Schimp. l. c., t. 259.

In the Yosemite Valley (*Dr. B. W. James*); alpine regions of Europe.

* * * *Calyptra cucullate, entire: diœcious.*

15. **G. montana,** Bruch & Schimp. Very much like *G. ovata,* but less rigid, the leaves a little broader and tipped with a longer roughish hair; calyptra long-beaked, reaching below the middle of the scarcely exserted capsule; annulus nearly wanting; operculum long-beaked, usually deciduous with the calyptra. — Bryol. Eur. t. 250; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 215.

Near San Francisco, on Monte Diablo, and on Mono Pass at 7,000 to 8,000 feet altitude (*Bolander*); in mountains, Nevada (*Watson*); Western Europe.

23. RHACOMITRIUM, Bridel.

Taller perennials, broadly cespitose, usually upon rocks, dichotomously branched. Leaves very densely crowded, subequal, long-lanceolate, blunt or setosely tipped, channelled with recurved margins; basal areolation linear and sinuous. Flowers diœcious. Calyptra conic-mitriform, lobed at base, with a straight dark more or less roughened beak. Capsule oblong-cylindric, on a rarely curved pedicel, with a narrow beaked operculum and broad compound annulus. Peristome elongated, upon a short basal membrane, purple, the teeth irregularly 2–3-cleft at least to the middle, or to the base with subequal filiform divisions, erect or nearly so when dry.

A genus variously limited, of 30 or 40 species, many antarctic; often included in *Grimmia.*

§ 1. *Regularly dichotomous: leaves blunt; areolation minute and rounded, at base linear and very sinuous; costa narrowly 2-winged on the back: pedicel arenate: operculum conic-rostrate: teeth bifid nearly to the base.* — CAMPYLODRYPTODON.

R. PATENS, Schimp. Stems 2 to 4 inches long, naked below: leaves spreading: pedicel rather short: capsule pale brown, oval, furrowed when dry. — Syn. Musc. 2 ed. 272. *Grimmia patens,* Bruch & Schimp. Bryol. Eur. t. 246; Wilson, Bryol. Brit. t. 19. Between Fort Colville and the Rocky Mountains, Washington Territory, *Drummond, Lyall.*

§ 2. *Dichotomous, fastigiately branched: leaves blunt; apical areolation quadrate or oval, the basal very narrow and sinuous: capsule erect: beak of calyptra rough, of operculum acicular: teeth bifid to or below the middle.* — DRYPTODON.

1. **R. aciculare,** Bridel. Loosely cespitose, dark green, 1 to 3 inches high: leaves secund or spreading, widely lanceolate or ovate-oblong, obtuse, entire or

toothed at top, costa ceasing below the apex: capsule brown, with short collum and small mouth: teeth bifid nearly to the base, the unequal subulate divisions connivent when dry. — Bruch & Schimp. l. c., t. 262; Wilson, l. c., t. 19; Berkeley, Brit. Moss. t. 21, fig. 3.

On granite rocks above the Yosemite Valley (*Bolander*); in the Alleghany Mountains, and mountains of Europe.

2. **R. depressum**, Lesq. Broadly cespitose, depressed, yellowish brown, the loosely leafy stems 4 or 5 inches long: leaves secund, erect, appressed when dry, lanceolate from a broadly ovate semi-auriculate decurrent base, obtuse, usually irregularly denticulate at the apex: capsule immersed upon a short pedicel, nearly cylindrical, with a short collum: teeth irregularly 3-parted or rarely bifid, the divisions distinct or more or less coherent. — Mem. Calif. Acad. i. 14.

Yosemite Falls, *Bolander*.

R. Nevii (*Grimmia Nevii*, Muell. Flora, xxxi. 483, and Torr. Bot. Bulletin, v. 6) is found at Portland, Oregon, *Nevius*. Dark green or blackish, the stems somewhat naked below: upper branchlets incurved, leafy: leaves appressed-imbricate or slightly spreading, broadly ligulate, obtuse, sparingly erose-denticulate at the apex, very concave, the inner perichætial nerveless: capsule oval on a very short curved pedicel: segments of the stout red teeth coherent.

§ 3. *Plants with more or less numerous short leafy lateral branchlets: leaves diaphanous at the apex (in our species) and setose-tipped: areolation, calyptra and operculum as in § 2: capsule erect: teeth divided into two long narrowly lanceolate or filiform segments.* — Rhacomitrium proper.

3. **R. canescens**, Bridel. Stems 2 to 4 inches long, erect, the many branches more or less fascicled, yellowish green or hoary: leaves spreading and recurved, the upper often secund, narrowly lanceolate from an oblong base, attenuate into a long white denticulate point, deeply carinate, minutely papillose throughout, the entire margin recurved: capsule on a long purple pedicel, ovate-conical with a narrow mouth, brown, obscurely striate when dry: operculum equalling or exceeding the capsule: teeth very long, filiform, erect, deep purple. — Bruch & Schimp. l. c., t. 270, 271; Wilson, l. c., t. 19; Fl. Dan. xv, t. 2561, fig. 1.

Shaded rocks near Paper Mill, Marin County, a variety with pellucid leaves, scarcely papillose, and areolation narrower (*Bolander*); Mount Ranier (*Pickering*); Vancouver Island (*Lyall*); White Mountains, N. Hampshire; throughout Europe. A variable species.

R. heterostichum, Brid., collected at Fort Colville (*Lyall*) and in Oregon (*Nevius*), has shorter stems (½ to 1½ inches long) sparingly branched, the elliptic- or obovate-cylindric capsule smooth when dry and exceeding the operculum, and the short teeth unequally and irregularly divided, incurved when dry. — Bruch & Schimp. l. c., t. 265; Wilson, l. c. *Trichostomum heterostichum*, Hedw. Musc. Frond. ii, t. 25. Also in Colorado (*Hall*) and Alaska, and European.

R. lanuginosum, Brid., from Vancouver Island (*Wood*) and Mount Ranier (*Pickering*), has its stems much elongated (4 to 12 inches), slender, fragile and much branched, with crowded linear-lanceolate dentate leaves: pedicels short, roughish: operculum as long as the small ovate smooth capsule: teeth very long, filiform. — Bruch & Schimp. l. c., t. 269; Wilson, l. c.; Fl. Dan. xv, t. 2561, fig. 2. *Trichostomum lanuginosum*, Hedw. l. c. iii, t. 2. In the White Mountains and Europe.

R. microcarpum, Brid.; Oregon, *Hall*. Habit of *R. canescens*, the stems fascicled, with numerous short branches: leaves crowded, recurved, lanceolate with a short white dentate point and the areolation throughout elongated and sinuous: capsule small and thin, cylindrical, pale, twice longer than the conic operculum. — Bruch & Schimp. l. c., t. 268; Wilson, l. c., t. 61. In the White Mountains and the Alleghanies and in Europe. Growing in dry places and maturing its fruit in autumn, not in the spring as the preceding species.

24. PTYCHOMITRIUM, Bruch & Schimp.

Perennials, loosely cespitose on rocks or rarely trees. Leaves dull, in 5 to 8 ranks, long-lanceolate, crisped, costate, the areolation at the apex minute and punctiform, at base short-linear or rectangular; perichætial leaves not distinct. Flowers monœcious, bud-like, the male terminal or axillary. Calyptra mitriform, reaching

to the middle of the capsule, incised at base and longitudinally plicate. Capsule erect, long-pedicellate, regular, with aciculate operculum and broad compound annulus. Peristome simple, of 16 long and narrow usually deeply cleft teeth.

About a dozen widely scattered species are referred to this genus.

1. **P. Gardneri,** Lesq. Stems branched, tufted: leaves dark green, crowded, twisted or crisped, reflexed when moist, acutely carinate, the margin above sharply serrate; basal areolation linear: male flowers rarely axillary, usually 2 to 4 within the perichætium: capsule (frequently 2 or more together) narrowly elliptical, pale brown, smooth, with long persistent reddish operculum: teeth mostly 3-cleft to the base, dark red. — Mem. Calif. Acad. i. 16.

On rocks in Dardanelles Cañon, Forest Hill, *Bolander*. Closely resembling *P. polyphyllum*, Bruch & Schimp., of Europe.

25. ORTHOTRICHUM, Hedw.

Roundish-tufted perennials, on trees or rocks, erect or procumbent, never creeping, dichotomously branched, with rootlets at base and at the axils of the branches. Leaves crowded, ovate- to long-lanceolate, strict when dry, costate, entire, margins usually revolute, dull and usually minutely papillose; areolation at base looser, rectangular and hyaline, above punctulate. Flowers monœcious or diœcious, terminal and bud-like. Calyptra large, campanulate, lobed-mitriform, longitudinally plicate, hairy or naked. Capsule immersed or more or less exserted, erect, symmetrical, 8–16-striate, ribbed when dry, more or less elongated, with distinct collum, a mamillate or conic-rostrate operculum, and a very narrow annulus or none. Peristome of 16 short pale teeth divided by a medial line and usually in pairs, with or without an inner row of 8 or 16 alternate filiform cilia.

A genus of 70 or more species, about half European, the rest belonging chiefly to the New World. Nearly 30 species are North American, half of which are also European.

The genus Ulota, Mohr, often included in *Orthotrichum*, is distinguished by its flexuous leaves crisped and twisted when dry, usually dilated at base with linear areolation, and the very hairy calyptra with more numerous folds. No species have been detected in California, but the following are found in Oregon and northward.

U. phyllantha, Brid. Densely tufted, 1 or 2 inches high, with long linear leaves, when dry twisted and circinate, the costa produced into the apex and there usually thickened and bearing brown jointed cylindrical gemmæ: fruit unknown. — *Orthotrichum phyllanthum*, Bruch & Schimp. Bryol. Eur. t. 223; Wilson, Bryol. Brit. t. 46. Oregon (*Hall*); Vancouver Island (*Wood*); Europe, Andes of South America, and antarctic regions.

U. crispula, Bruch. Leaves crowded, linear-lanceolate, crisped when dry: capsule short-pedicelled, pale yellow, clavate-pyriform, narrowly 8-striate: calyptra conic-campanulate: teeth short, reflexed when dry, with 8 or 16 short cilia. — *Orthotrichum crispum*, Hedw. Musc. Frond. ii. 96, t. 35; Bruch & Schimp. l. c., t. 228; Wilson, l. c., t. 45. Oregon (*Nevius, Hall*); Europe.

* *Peristome simple, the inner cilia wanting or only rudimentary.*

1. **O. cupulatum,** Hoffm. Tufts more or less crowded, an inch high, red- or brownish-green: leaves crowded, spreading or when dry strict, oblong-lanceolate, with reflexed margins: calyptra campanulate, sparingly hairy: capsule obovate, immersed on a short pedicel, thick, pale brown, 16-striate, with a pale yellow convex straight-beaked operculum: peristome of 16 distinct pale yellow teeth, radiately spreading when dry. — Bruch & Schimp. l. c., t. 209; Wilson, l. c., t. 21; Berkeley, Brit. Moss. t. 20, fig. 4; Sulliv. Icon. Musc. Suppl. 61, t. 44 (var. *minus*).

On limestone rocks near Russian River (*Bolander*); also from British America to the Atlantic States and New Mexico, in several forms, and in Europe.

2. **O. Sturmii,** Hoppe & Hornsch. Usually larger than the last, in broader circular tufts: leaves spreading and recurved, the margins revolute, and the upper

part formed of a double layer of cells: capsule obscurely 8-striate, the calyptra usually very hairy, and the peristome-teeth erect when dry. — Bruch & Schimp. l. c., t. 209; Fl. Dan. xv, t. 2560, fig. 2.

On shaded rocks in Yosemite Valley (*Bolander*); W. Humboldt Mountains, Nevada (*Watson*); Texas (*Wright*); also in the White Mountains, in Europe, and the Sandwich Islands.

3. **O. anomalum,** Hedw. Stems erect, about an inch high, subsimple: leaves rather firm, spreading or the upper crowded and more erect, strict when dry, lanceolate, papillose, with revolute margins, basal areolation rectangular: calyptra campanulate, hairy: capsule exserted on a long pedicel, ovate-oblong, reddish brown, with 8 or sometimes 16 orange stria: teeth in pairs, erect when dry; 8 rudimentary cilia sometimes present. — Musc. Frond. ii. 102, t. 37; Bruch & Schimp. l. c., t. 210; Wilson, l. c., t. 21; Berkeley, l. c. fig. 5; Fl. Dan. t. 2615.

Washoe Mountains, near Carson City (*Watson*), a form with thicker, more papillose and more revolute leaves, with closer areolation, and the calyptra more pilose. The typical form is found from Arctic America and Greenland to Colorado and the Atlantic States; also Europe.

4. **O. Texanum,** Sulliv. Stems nearly an inch high, loosely leafy, cespitose or in small brownish- or dark-green tufts: leaves linear-lanceolate, recurved-spreading, erect-spreading when dry, carinate-costate with reflexed margins, somewhat folded above and very minutely papillose: flowers monœcious, the male axillary: calyptra very pilose: capsule immersed, oblong-obovate upon a short collum, prominently 8-ribbed the whole length when dry; operculum short-rostrate: teeth in pairs, pale yellow, often with 16 rudimentary cilia. — Gray's Manual, 2 ed. 633, and Icon. Musc. 53, t. 34; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 122.

Var. **globosum,** Lesq. Capsule shorter, subglobose, emergent upon a somewhat longer pedicel, with a brown shining calyptra; stem shorter, the leaves erect when moist. — Mem. Calif. Acad. i. 17.

Common on rocks and trees, and very variable (*Bolander*); Texas and New Mexico, *Wright, Fendler.*

5. **O. Watsoni,** James. Loosely tufted, green, pale ochre below, sparingly branched, 6 to 10 lines high: leaves rather soft and loose, long-lanceolate and acute, recurved, carinate, margins revolute, covered above with 2–3-forked papillæ: flowers monœcious: calyptra somewhat hairy: capsule emergent, subelliptical when dry, prominently ribbed and contracted below the dilated mouth; operculum short-rostrate: teeth yellowish white, closely connate in pairs, erect-spreading when dry. — Bot. King Exp. 401; Sulliv. Icon. Musc. Suppl. 73, t. 54.

On damp shaded rocks, West Humboldt Mountains, Nevada, *Watson.*

6. **O. Jamesianum,** Sulliv. Stems sparingly branched, 6 to 8 lines high, in rather loose tufts, pale green or cinereous when dry, brownish below, subjulaceous: leaves oblong or lanceolate-oblong, obtuse, subcarinate, papillose, the margins revolute, and costa ceasing below the apex: flowers monœcious, the male axillary: calyptra sparingly hairy: capsule immersed, pyriform, short-pedicelled, 8-ribbed when dry and constricted below the broad mouth: teeth distinct, transversely vermiculate at base, longitudinally at the apex, and circularly in the middle. — Bot. King Exp. 401, and Icon. Musc. Suppl. 71, t. 53.

On limestone rocks in the East Humboldt Mountains, Nevada (*Watson*); Fort St. James, British Columbia, *Macoun.*

* * *Peristome double.*

7. **O. rupestre,** Schleich. Stems rather long, forming loose circular brownish tufts, branching: leaves spreading, somewhat recurved, strict and rigid when dry, lanceolate acute, deeply carinate above, with revolute or involute margins, minutely papillose: calyptra campanulate, very villous with yellow hairs: capsule immersed or emergent, pyriform, pale yellow becoming brownish, faintly 8-striate, when dry scarcely contracted below the mouth: teeth rather long, pale, in pairs or at length

distinct, erect or slightly spreading when dry; cilia 8, linear-lanceolate, nearly equalling the teeth. — Bruch & Schimp. Bryol. Eur. t. 217; Wilson, l. c., t. 34.

On rocks, Big Tree Grove and Yosemite Valley (*Bolander*); E. Humboldt Mountains, Nevada (*Watson*); Arctic America and mountains of Europe.

8. **O. Bolanderi**, Sulliv. Stems densely leafy, nearly an inch high, sparingly branched from the base, dark green, cespitose: leaves recurved-spreading when moist, oblong-lanceolate, acutish, obscurely papillose, the areolation above of dense bistromatic cells: monœcious; male flowers axillary: calyptra hairy: capsule on a very short pedicel, half emersed, oblong-oval, on a short collum: teeth long, in pairs, 18–20-jointed, densely punctulate, yellowish; cilia 8, as long as the teeth. — Icon. Musc. Suppl. 64, t. 46.

On rocks, *Bolander*.

9. **O. speciosum**, Nees. Stems tall (1 or 2 inches), loosely cespitose, green or yellowish green: leaves more or less spreading, long-lanceolate, acuminate, carinate, the margins revolute: male flowers axillary: calyptra ovate-campanulate, very hairy: capsule emergent and exserted, cylindric-oblong upon a short collum, pale yellow, smooth, at length obsoletely 8-plicate: teeth in pairs, yellowish, reflexed when dry, densely papillose, equalling the 8 cilia. — Bruch & Schimp. l. c., t. 217; Wilson, l. c., t. 34. *O. elegans*, Schwaegr.

On trees and rocks, Big Trees and elsewhere (*Bolander*); Fort Colville and British Columbia (*Lyall*); St. Lawrence River, and European. Very variable.

10. **O. alpestre**, Hornsch. More or less densely cespitose, and from deep green to yellowish or brownish: leaves long-lanceolate, with revolute margins, papillose and minutely crenulate above: male flowers terminal: calyptra nearly naked, covering two-thirds of the capsule, straw-colored with brown apex: capsule emergent, oval with short collum, pale yellow, striate, when dry urceolate and broadly ribbed: teeth connate in pairs, reflexed when dry, equalling the 8 cilia. — Bruch & Schimp. l. c., t. 213; Sulliv. Icon. Musc. Suppl. 69, t. 51. *O. occidentale*, James, Bot. King Exp. 402.

Monte Diablo (*Gibbons*); Wahsatch and Uinta Mountains (*Watson*); Rocky Mountains of British America (*Drummond*); Central Europe. The specimens differ from the normal form in their glaucous-green color, the broader thick leaves with elongated simple or forked papillæ, and the longer entire teeth minutely punctate.

11. **O. rivulare**, Turner. Stems lax, tufted, elongated, often floating, branched above, naked at base: leaves dark green or blackish, oblong-ovate to ligulate, obtuse, spreading, smooth, with revolute margin: male flowers terminal: calyptra naked, pale- or dark-green, blackish above, covering half of the capsule: capsule half immersed, pyriform, yellow, obscurely 8-striate, urceolate and ribbed the whole length when dry: teeth orange, in pairs, at length somewhat separated, reflexed when dry; cilia 8 longer and 8 shorter than the teeth. — Musc. Hib. 96, t. 8; Bruch & Schimp. l. c., t. 219; Wilson, l. c., t. 21.

On roots of trees, etc., in water, Anderson Valley, common, *Bolander;* Europe.

12. **O. cylindrocarpum**, Lesq. Stems simple or sparingly branched, slender, 2 to 4 lines long, densely leafy, in loose dull green tufts blackish below: leaves erect, appressed when dry, long-lanceolate, acutish or subobtuse, carinate, the stout nerve ceasing below the apex, margins revolute, minutely papillose above: flowers monœcious, the male rarely axillary: calyptra very hairy, nearly covering the capsule: capsule exserted, cylindric or narrowly oval, pale green or yellowish, obscurely 8-striate, very narrowly 8-ribbed when dry: teeth approximate in pairs, 9–10-jointed, granulose, reflexed when dry, equalling the 8 stout cilia. — Trans. Amer. Phil. Soc. xiii. 6, and Mem. Calif. Acad. i. 17; Sulliv. l. c. 70, t. 52; Sulliv. & Lesq. l. c. 2 ed. n. 178. *O. Coulteri*, Mitten, Journ. Linn. Soc. viii. 25.

On rocks and bark of oak-trees, Dardanelles Cañon (*Bolander*); also by *Coulter*.

13. **O. Kingianum**, Lesq. Stems sparingly branched, an inch high, in dull green tufts, brown below: leaves erect-spreading when moist, ovate-lanceolate, obtusely acute, revolute in the middle, carinate, the costa ceasing below the apex, granulose-papillose above: monœcious, the male buds axillary, slender: calyptra sparingly hairy, covering the brown smooth oval capsule, which is exserted upon a pedicel 2 or 3 lines long, long-cylindric when dry: teeth in pairs, 9–10-jointed, punctate, erect when dry, longer than the 8 cilia. — Mem. Calif. Acad. i. 18; Sulliv. Icon. Musc. Suppl. 74, t. 55. *O. lævigatum*, James, Bot. King Exp. 402, not Zett.

On rocks near the Yosemite Falls (*Bolander*); Pah-Ute Mountains, Nevada (*Watson*). Sullivant in his manuscript notes refers this species to *O. speciosum*.

14. **O. pulchellum**, Smith. Stems loosely cespitose, about 3 lines high, very slender: leaves pale green, soft, spreading, lax and slightly crisped when dry, linear-lanceolate, acuminate, margins revolute below, very minutely punctate and revolute toward the apex: male flowers terminal: calyptra campanulate, naked, pale yellow with a brown point: capsule exserted on a rather long pedicel, small, oblong with a short collum, yellowish, indistinctly 8-striate, becoming sulcate below the mouth and contracted: teeth red-orange, rather long, in pairs, reflexed when dry, with 16 equal filiform cilia. — Engl. Bot. t. 1787; Bruch & Schimp. l. c., t. 223; Wilson, l. c., t. 21; Berkeley, l. c. fig. 7. *O. Columbicum*, Mitten, Journ. Linn. Soc. viii. 24?

Clear Lake and Eureka (*Bolander*); Vancouver Island; Northern Europe. Peristome somewhat paler and pedicel longer than in the European type. *O. Columbicum*, from Vancouver Island, is described as having but 8 cilia and the calyptra rugose at the apex.

O. CONSIMILE, Mitt. l. c. (Sulliv. Icon. Musc. Suppl. 59, t. 43), also from Vancouver Island, is very similar but with shorter capsule, the calyptra somewhat hairy, and the cilia only 8.

15. **O. Lyellii**, Hook. & Tayl. Stems loosely tufted, 2 to 4 inches long, much branched: leaves crowded, flexuose-squarrose, when dry nearly erect and somewhat twisted, linear-lanceolate, acute, margins flat, beset with red clavate hairs or papillæ: dioecious: calyptra large, moderately hairy, conic-campanulate: capsule emergent, ovate upon a long collum, faintly 8-striate, elongated and deeply striate when dry, yellowish brown: teeth whitish, reflexed when dry; cilia 16, red, slightly erose on the hyaline margin. — Musc. Brit. t. 22; Bruch & Schimp. l. c., t. 221; Wilson, l. c., t. 22; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. 184, 185. *O. papillosum*, Hampe, Linnæa, xxx. 458.

On trees, California and Oregon, common; Europe.

26. ENCALYPTA, Schreb.

Somewhat cespitose branching perennials, on the ground or rocks, the stem rhizoid-bearing the whole length. Leaves 5-ranked, dull green, linear to spatulate, densely covered above with cleft papillæ; areolation close hexagonal toward the apex, long-rectangular and hyaline at base. Inflorescence monœcious (rarely dioecious), bud-like. Calyptra very large, longer than the capsule, cylindric-campanulate, very smooth, with long slender beak. Capsule erect upon a long pedicel, oblong or cylindric, with a short collum; operculum beaked like the calyptra. Peristome very variable, single, of 16 teeth (in our species), or double, much as in *Orthotrichum*, sometimes wanting.

A genus of about 20 species, largely European. Resembling in habit the larger species of *Barbula*, but readily distinguished by the calyptra.

* *Peristome very fugacious and fragile, or often wanting.*

1. **E. vulgaris**, Hedw. Stems scarcely 6 lines long: leaves spreading, lingulate, apiculate, twisting when dry, the reddish costa ceasing below the apex or slightly excurrent: calyptra entire at base, yellowish green: capsule ovate-cylindrical,

thin, pale yellow, orange above and below, minutely sulcate when dry : teeth usually none, or very irregular, short and obtuse, pale. — Musc. Frond. i, t. 18 ; Bruch & Schimp. Bryol. Eur. t. 199 ; Wilson, Bryol. Brit. t. 13 ; Berkeley, Brit. Moss. t. 22, fig. 1 ; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. 167.

Monte Diablo and Oakland Hills (*Bolander*) ; Fort Colville (*Lyall*) ; mountains of Nevada and Utah (*Watson*) ; Colorado (*Hall*) ; White Mountains, and throughout Europe.

* * *Peristome persistent.*

2. **E. ciliata,** Hedw. Stems ½ to 1 inch high, loosely cespitose, branched : leaves bright or pale green, soft, spreading, crowded, oblong-ovate or ligulate, shortly acuminate, slightly concave, margin somewhat undulate, the costa slightly excurrent or ceasing below the suberenulate apex ; areolation very granulose above : calyptra lanceolate-lobed and fringed at base, pale yellow : capsule on yellowish pedicels, smooth, long-cylindric, at length reddish brown, without annulus : teeth usually narrowly lanceolate, orange-colored, horizontally inflexed when dry, spreading when moist, rarely wanting. — Engl. Bot. t. 1418 ; Bruch & Schimp. l. c., t. 200 ; Wilson, l. c., t. 13. *Leersia ciliata,* Hedw. Musc. Frond. i, t. 19.

Yosemite Valley, near Nevada Fall, and banks of Russian River near Ukiah (*Bolander*) ; Oregon (*Hall*) ; Colorado (*Wolf*) ; Lake Superior and Northern New York ; Europe.

3. **E. rhabdocarpa,** Schwaegr. Differing in its leaves, often piliferous at the apex ; calyptra slightly jagged at the base and scabrous at the apex ; capsule ovate-cylindrical, brownish with 8 to 16 reddish striæ, and deeply sulcate when dry, annulate ; peristome reddish, rarely pale or wanting. — Suppl. i. 56, t. 16 ; Bruch & Schimp. l. c., t. 204 ; Wilson, l. c., t. 32 ; Sulliv. in Gray's Manual, 2 ed. t. 2.

In the East Humboldt Mountains, Nevada (*Watson*) ; Washington Territory (*Lyall*) ; Arctic America to Colorado ; Europe.

27. TAYLORIA, Hook.

Loosely cespitose perennials, on the ground, branching, rhizoid-bearing the whole length. Leaves erect-spreading in several ranks, soft, ovate-lanceolate, clasping, acute, costate, coarsely serrate above, of large thin parenchymatous cells. Flowers terminal ; the male discoid, of numerous short-pedicelled antheridia and clavate paraphyses. Calyptra mitriform, cleft at one side. Capsule long-pedicelled, decurrent into a long thick clavate collum of the same color, erect, regular, becoming brownish, with convex-conic operculum and no annulus. Peristome of 16 linear-lanceolate entire or at length divided teeth, very hygroscopic, reflexed when dry. Columella persistent.

A small genus, mostly alpine and growing upon decayed vegetable or animal substances. European and South American.

Dissodon, Grev. & Arn., is a nearly allied genus, growing on the ground, and distinguished by obtuse entire somewhat obovate leaves, the male flowers bud-like, and the acute or truncate teeth erect-incurved when dry.

D. Hornschuchii, Grev. & Arn., a European species which has been found in the Rocky Mountains (*Drummond*) and in Oregon (*Downie*), may be met with in California. It has broadly oblong or obovate green and shining leaves, the long-clavate capsule erect upon a shortish thick pedicel, a broad operculum borne upon a tall stout persistent columella, and truncate bifid teeth.

1. **T. splachnoides,** Hook. Stems 1 inch high, erect : leaves imbricated, pale green, more or less obtuse and serrate : capsule on a reddish pedicel 1 or 2 inches long, oblong-cylindric, as long as the narrower collum ; operculum long-conic : teeth very long and attenuate, at length cleft to the base, involute within the orifice or on drying circinate-flexuous and reflexed, pale purple : columella exserted, filiform, with capitate summit. — Musc. Exot. t. 173 ; Bruch & Schimp. Bryol. Eur. t. 286 ; Fl. Dan. Suppl. t. 44. *Hookeria splachnoides,* Schleich. ; Schwaegr. Suppl. t. 100.

At Unionville, West Humboldt Mountains, Nevada (*Watson*); Rocky Mountains of British America (*Drummond*); Europe.

T. SERRATA, Bruch & Schimp. (Bryol. Eur. t. 284, 285), was collected at Fort Colville by *Lyall*. Fertile stems procumbent: capsule brownish red, on an erect pedicel: teeth dark purple, shining, linear-lanceolate, when dry arcuate-erect or loosely reflexed: columella included.

28. SPLACHNUM, Linn.

Soft loosely cespitose annuals (rarely perennial), on the ground or cattle-dung; rhizoids at base. Leaves remote, spreading, the uppermost crowded, broadly obovate-lanceolate, narrowed at base, entire or serrate, the areolation very loose. Male flowers subdiscoid. Calyptra small, conic, very fugacious. Capsule long-pedicelled, small, short-cylindrical upon a spongy at length much thickened and subglobose, pyriform or umbrella-shaped apophysis, differing from it in color; operculum convex; annulus none. Peristome of 16 orange-colored linear teeth, in pairs, appressed-reflexed when dry. Columella persistent.

A genus of half a dozen species in Europe and North America, and another in Tasmania.

1. **S. luteum,** Linn. Annual, dioecious; stem ½ inch high or less, simple or branched at base: leaves rather large, long-apiculate, entire: capsule on a pedicel an inch long or more, brownish upon a lemon-colored broadly dilated flat-umbrella-shaped apophysis: teeth orange, many-jointed. — Amœn. ii. 277, t. 3; Hedw. Musc. Frond. ii. 48, t. 17; Bruch & Schimp. Bryol. Eur. t. 296. *S. melanocaulon*, Schwaegr. Suppl. t. 109.

Reported by Mitten (Journ. Linn. Soc. viii. 22) as collected at various times in western North America and in the Rocky Mountains, and as varying much in the length of the pedicel and size of the apophysis. It is found in Northern Europe and Kamtschatka, and may range to the mountains of California.

29. PHYSCOMITRIUM, Brid.

Low clustered or loosely cespitose annuals, on the ground; stem simple or branched at base. Leaves crowded above, rather broad, acuminate, soft and smooth, of large hyaline cells; costa thin. Inflorescence monœcious, terminal, the male flowers discoid. Calyptra vesicular, 4-angled, 5-lobed at base, with a long straight beak, half-covering the capsule. Capsule ovate- or globose-pyriform, erect on an exserted pedicel or immersed, regular, with flattish-convex operculum. Peristome wanting.

About 16 species are known, widely scattered, one-half South American. Four species besides the following are found in the Atlantic States, and a fourth in the Wahsatch Mountains.

1. **P. pyriforme,** Bridel. Stems 2 to 5 lines high: leaves more or less spreading, spatulate-lanceolate, coarsely serrate above the middle: capsule globose-pyriform, exserted on a pedicel 5 to 8 lines long, at length brownish red, the cells bordering the orifice transversely rectangular, in 12 to 15 rows; operculum convex-conic; annulus double. — Bruch & Schimp. Bryol. Eur. t. 299; Wilson, Bryol. Brit. t. 7. *Gymnostomum pyriforme*, Hedw.; Engl. Bot. t. 413.

On wet banks in Dardanelles Cañon and in swamps near San Rafael (*Bolander*); very common in the Atlantic States as well as throughout Europe. The largest species of the genus.

30. ENTOSTHODON, Schwaegr.

Resembling the preceding genus. Leaves very variable in the same species. Calyptra vesicular-cucullate, long-beaked, shining. Capsule exserted, erect or slightly nodding, regular pyriform, with small plano-convex or rarely umbonate

operculum, and no annulus. Peristome single (or none), of 16 short linear-lanceolate punctulate teeth, inserted within the orifice and horizontal.

Thirty or more species are described, one-half of them South American. The following are the only North American species, with a single exception.

1. **E. Templetoni**, Schwaegr. Stems 3 to 6 lines high; lower leaves very small, remote, the upper (6 or 8) rosulate, broadly obovate- to spatulate-oblong, acuminate, the margin subcrenate from the prominent cells, costa ceasing below the apex, the areolation rather large: capsule erect on a pedicel nearly $\frac{1}{2}$ inch long, yellowish brown, narrowly pyriform, the long collum attenuate into the pedicel; operculum plano-convex: teeth lanceolate-subulate, with broader confluent base, remotely articulated, reddish. — Suppl. t. 113; Bruch & Schimp. Bryol. Eur. t. 302; Wilson, Bryol. Brit. t. 14; Berkeley, Brit. Moss. t. 16, fig. 5.

Swamp near Mendocino (*Bolander*); Europe.

2. **E. Bolanderi**, Lesq. Resembling the last; stem scarcely 2 lines high, erect from a decumbent base: leaves yellowish green, longer acuminate, more loosely areolate, and the costa wanting or scarcely reaching the middle; perigonial leaves nerveless: capsule with a longer somewhat inflated collum; operculum umbonate or apiculate-convex: teeth pale, linear-lanceolate, equal, very minutely granulose, not nodose, the articulations and medial line obscure. — Trans. Amer. Phil. Soc. xiii. 10; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 236; Sulliv. Icon. Musc. Suppl. 28, t. 17.

On clayey ground near San Francisco, *Bolander.*

31. FUNARIA, Schreber.

Differing from the preceding in the obliquely pyriform capsule and in the characters of the peristome. Stem at first simple, bearing a discoid male flower, the female flowers terminal on later branches; rootlets at base of the stem and branches: capsule more or less nodding upon a long erect or arcuate at length twisted pedicel, obliquely pyriform with a small oblique mouth, rather ventricose; operculum flat-convex or convex-conic; annulus none or large and double: peristome double, from below the orifice, the outer of 16 oblique linear-lanceolate prominently jointed teeth connivent at apex upon a small reticulated disk, reddish purple at base, paler above; the inner of as many yellowish lanceolate cilia opposite to the teeth.

About 20 species, of which 8 are found in North America.

* *Capsule suberect upon a straight pedicel, without annulus.*

1. **F. Californica**, Sulliv. & Lesq. Loosely cespitose, pale green, the stems 1 or 2 lines high: upper leaves erect and crowded, oblong, shortly acute, concave, entire, the costa continuous nearly to the apex, marginal areolation subquadrate toward the apex, longer below: pedicel scarcely an inch long, twisted to the left when dry; capsule oblong-pyriform, only slightly unsymmetrical, with a depressed-conic operculum: teeth and cilia adherent to above the middle. — Musc. Am.-Bor. Exsicc. 2 ed. n. 238; Lesq. in Mem. Calif. Acad. i. 20; Sulliv. Icon. Musc. Suppl. 29, t. 18.

On moist clayey soil, at Auburn, Ukiah, etc. (*Bolander*); Oregon, *Hall.*

2. **F. calcarea**, Wahl. Loosely cespitose, stems 1 to 3 lines high: leaves below oblong-lanceolate and deflexed, the upper more or less spreading, obovate-oblong, more or less abruptly-acuminate, finely apiculate or terminating in a long flexuose point, obtusely serrate or nearly entire, the yellow costa ceasing near the apex: pedicel (6 to 8 lines long) twisted to the right when dry or the lower part to

the left: capsule brownish, shortly pyriform; operculum convex-conic, blunt. — Schimp. Syn. 2 ed. 382. *F. Muhlenbergii*, Schwaegr. Suppl. i². 78, excl. t.; Bruch & Schimp. Bryol. Eur. t. 303; Wilson, Bryol. Brit. t. 20. *F. Hibernica*, Hook. & Tayl.; Bruch & Schimp. l. c., t. 304; Wilson, l. c. *F. Mediterranea*, Lindb.; Sulliv. Icon. Musc. Suppl. 31.

At Mission Dolores and on Monte Diablo (*Bolander*); Cajon Pass and Colorado Valley (*Bigelow*); Salt Lake, Utah (*Watson*); British America (*Drummond*); and very common throughout Europe and in Asia and Africa. Schimper unites the two species which have long been kept apart upon the variations in the shape of the leaves and in the torsion of the pedicel. The typical form (the *F. Hibernica*) has the more attenuate and more acutely serrate leaves, and the pedicel twisted more or less to the left.

* * *Capsule more or less nodding upon an arcuate pedicel; annulus present.*

3. **F. hygrometrica,** Hedw. Stems 3 to 10 lines high: upper leaves crowded and connivent, or rarely spreading, broadly ovate-lanceolate, concave, entire, costate nearly to the apex, only the perigonial ones serrate at the apex and base: capsule turgid-pyriform, deep yellow to red, horizontal or pendent upon a flexuous arcuate pedicel ½ to 3 inches long, deeply sulcate when dry and the very oblique margin corrugated; operculum broadly convex; annulus large, at length unrolling. — Bruch & Schimp. l. c., t. 305; Wilson, l. c.; Sulliv. in Gray's Man. 2 ed. t. 3; Berkeley, Brit. Moss. t. 16, fig. 6.

Var. **calvescens,** Bruch & Schimp. Pedicel straight: capsule narrower and nearly erect: leaves spreading, rather longer and narrowed, twisted when dry. — *F. calvescens*, Schwaegr. Suppl. t. 65.

In various localities through the State (*Coulter, Bigelow, Pickering, Bolander*), and found in nearly all parts of the world. The variety, which is more confined to warm regions, has been collected in American Fork Cañon (*Brewer*), and near Carson City, *Watson.*

4. **F. microstoma,** Bruch & Schimp. Differing from the last in the stouter pedicel, the firmer somewhat shining deep chestnut-colored capsule, only obscurely sulcate when dry, the margin of the much smaller orifice not corrugated, the inner peristome rudimentary, and the spores a half larger. — Bryol. Eur. t. 306.

At Soda Springs, on the Upper Tuolumne (*Bolander*); Illinois; European.

5. **F. convoluta,** Hampe. Loosely cespitose, the stem with the pedicel an inch high: outer leaves spreading with involute margins, the upper convolute and embracing the pedicel, oblong-ovate, acute, nearly entire, the costa reaching the apex: capsule ascending, at length nearly erect, obliquely pyriform, more or less plicate; operculum umbonate, acute: teeth broadly lanceolate, yellowish, the tips incurved. — Linnæa, xxx. 455.

In the Sierra Nevada, at 3,000 to 5,000 feet altitude, *J. Bauer*. Hampe compares this species with var. *calvescens* of *F. hygrometica*, from which he differentiates it by the shorter leaves, the smaller and thinner-walled cells, the acute umbonate operculum and the yellowish teeth. It is to be inferred that the capsule is annulate.

32. LEPTOBRYUM, Schimp.

Stems low, cespitose, on the ground, simple or innovating from the base, rooting only at base. Leaves numerous, linear-setaceous (the lower much smaller and remote), with broad excurrent serrate costa, areolation linear-rhombic above, smooth and shining. Flowers bisexual; paraphyses filiform, acute. Fruit as in *Bryum;* but the stipitate sporangium much smaller than the cavity of the capsule.

Only two species, the second Peruvian.

1. **L. pyriforme,** Schimp. Stems ¼ to 1 inch high: leaves soft and green, with silky lustre, spreading, flexuose: capsule inclined or pendulous, ovate-pyriform with long collum and convex apiculate operculum, thin, yellowish brown and shining: ciliolæ present. — Coroll. Bryol. Eur., and Syn. 2 ed. 390; Wilson, Musc. Brit.

t. 28; Berkeley, Brit. Moss. t. 18, fig. 3. *Bryum pyriforme*, Linn.; Hedw. Hist. Musc. t. 3, fig. 13; Bruch & Schimp. Bryol. Eur. t. 335; Fl. Dan. t. 2380, fig. 2.

At Cajon Pass (*Rigelow*), Clear Lake (*Bolander*), and common in the Sierra Nevada and in the mountains northward and eastward across the continent. Also frequent in Europe, Asia and South America.

33. BRYUM, Dill.

Cespitose perennials, on the ground or rocks; stems simple or sparingly innovating near the flowering apex, often with rhizoids the whole length. Leaves in several ranks, the upper larger and more crowded, usually ovate or lanceolate, smooth, the costa mostly percurrent or nearly so, with rather large subequal rhombic- or rectangular-hexagonal areolation, usually more or less serrate. Male flowers discoid or bud-like, with filiform paraphyses. Calyptra narrow, cucullate, fugacious, smooth. Capsule long-pedicellate, solitary, pyriform or oblong, with long or rather short collum, inclined or pendulous, smooth, mostly annulate; operculum convex, apiculate or shortly rostellate. Peristome double; outer of 16 linear-lanceolate or lanceolate teeth, with sinuous medial line and joints prominent on the inner side, incurved when dry; the inner a basal membrane, divided half-way down into carinate processes or cilia (sometimes splitting through the keel), alternate with the teeth, and usually with (1 to 3) interposed filiform ciliolæ.

A genus of over 200 species, of which one-half are South American and a fourth European. About 45 species are found in North America. The section *Webera* is restored to the rank of a genus by Schimper in the last edition of his Synopsis.

§ 1. *Stems simple or innovating usually at the base: leaves mostly narrowly lanceolate, shining, with elongated hexagonal areolation; costa ceasing below the apex: ciliolæ wanting or imperfect, or filiform and not appendiculate.* — WEBERA. (*Webera*, Hedw.)

* *Capsule narrowly pyriform with long collum: inner teeth entire or scarcely fissured; ciliolæ none or imperfect: flowers monœcious in* n. 1.

1. **B. polymorphum**, Bruch & Schimp. Loosely cespitose; stems usually very short, simple or rarely branched: upper leaves crowded, spreading, oblong-lanceolate, sharply serrate above, lower margins reflexed: antheridia hypogynous, axillary: capsule oval-oblong, horizontal or inclined, reddish brown, with bluntly conic operculum and large annulus: outer peristome reddish brown, the inner yellowish, without ciliolæ. — Bryol. Eur. t. 344; Wilson, Bryol. Brit. t. 47. *Pohlia polymorpha*, Hoppe & Hornsch. *Webera polymorpha*, Schimp.

On Mount Dana (*Bolander*); Oregon, *Hall*. Throughout Europe; a very variable species.

B. LONGICOLLUM, Swartz, found in the Cascade Mountains of Washington Territory (*Lyall*), is a taller deep-green species, with broader leaves, shorter collum, and a bright yellow peristome with more or less developed ciliolæ.

2. **B. nudicaule**, Lesq. Densely cespitose, brown below, green above; stem slender, 4 or 5 lines high, nearly naked to above the middle: leaves crowded, erect, ovate-lanceolate, acute, obsoletely denticulate above; the inner perichætial shorter and denticulate, sometimes with free antheridia in the axils: capsule horizontal or pendulous, usually slightly unsymmetrical, brown, with depressed conical operculum and compound annulus: inner peristome deeply divided, the narrow elongated teeth narrowly fissured, without ciliolæ. — Mem. Calif. Acad. i. 21; Sulliv. Icon. Musc. Suppl. 49, t. 34.

On Mount Dana, at 11,000 feet altitude, *Bolander*.

3. **B. Bolanderi**, Lesq. Loosely cespitose, pale green and shining; stems short, simple, leafy: lower leaves loosely imbricated, erect, lanceolate; the upper

crowded, longer, narrowly lanceolate, strongly denticulate; perigonial leaves broadly ovate with a long flexuose acumination, nearly entire: capsule inclined or horizontal, short-ovate, attenuate into a rather long collum; operculum conic, apiculate; annulus compound: outer teeth broad and short, the inner longer with rudimentary ciliolæ in pairs or wholly wanting. — Mem. Calif. Acad. i. 22.

Foot of Mount Dana, *Bolander.*

* * *Capsule broader with the collum short: ciliolæ perfect.*

+ *Monœcious: antheridia axillary.*

4. **B. nutans,** Schreb. Stems ¼ to 2 inches long, simple or branching above: lower leaves ovate-lanceolate, entire, the upper gradually larger, linear-lanceolate and serrate above: capsule mostly pendulous, pyriform or oblong-ovate, at length reddish-brown; operculum apiculate; annulus broad: teeth orange-red, with pale filiform tips; inner cilia and ciliolæ as long, the former broadly fissured. — Smith, Engl. Bot. t. 1240; Bruch & Schimp. l. c., t. 343; Wilson, l. c., t. 29. *Webera nutans,* Hedw. Musc. Frond. t. 4.

Var. **bicolor,** Bruch & Schimp. l. c., t. 347. Perichætial leaves erect, shorter: capsule shorter, thicker, variegated: leaves of the sterile branches ovate, acuminate, the costa excurrent. — *Webera bicolor,* Hoppe & Hornsch.

Foot of Mount Dana (*Bolander*); from Arctic America to Utah, Colorado and the Atlantic States. A common and very variable species, found also in Europe, Asia and South America. The variety was collected on the banks of King's River, at 4,000 feet altitude (*Brewer*), and on Mount Dana (*Bolander*); likewise European.

5. **B. cucullatum,** Schwaegr. Alpine, and like alpine forms of the last species: distinguished by its broader, softer and scarcely shining leaves, the thicker capsule with small orifice (the margin reflexed when dry), and the smaller peristome, the inner less developed with short and fugacious ciliolæ. — Suppl. i². 94, t. 68; Bruch & Schimp. l. c., t. 343; Fl. Dan. xv, t. 2683. *Webera cucullata,* Schimp.

On Mount Dana (*Bolander*); White Mountains, New Hampshire; mountains of Europe.

+ + *Flowers diœcious, or also bisexual in* n. 6.

++ *Leaves narrow, the upper linear-lanceolate.*

6. **B. crudum,** Schreb. Loosely cespitose, glaucous-green; stems 1 or 2 inches high, purple: lower leaves ovate-lanceolate, entire, the upper crowded, linear-lanceolate, flexuose-spreading, remotely serrate above, all shining and transparent: capsule rarely pendulous, oblong or ventricose, often gibbous: operculum convex, more or less apiculate: peristome pale yellow; ciliolæ in pairs or threes. — Engl. Bot. t. 1604; Bruch & Schimp. l. c., t. 348; Wilson, l. c., t. 28; Fl. Dan. t. 2682. *Mnium crudum,* Hedw. Musc. Frond. i. 99, t. 37. *Webera cruda,* Schimp.

Around Clear Lake and in the Calaveras Grove (*Bolander*); East Humboldt Mountains, Nevada (*Watson*); and from subarctic America to Utah, Colorado and the northern Atlantic States. Also in Central America and Mexico, Patagonia and Europe.

++ ++ *Leaves broader, the upper ovate-lanceolate.*

7. **B. commutatum.** Cespitose, bright green, reddish brown below; stems an inch high or more when dry, leaves shining, rather firm, erect-spreading, imbricate, the lower ovate or ovate-lanceolate, the upper gradually larger, oblong- to linear-lanceolate, concave with reflexed margins, scarcely decurrent, the purplish costa ceasing at or near the serrulate apex: male flowers with axillary antheridia and numerous paraphyses: capsule inclined or subpendulous, slightly incurved, brownish; operculum obtuse: teeth large, yellow, the inner pale, with gaping fissures and ciliolæ in pairs or threes. — *Bryum Ludwigii,* Bruch & Schimp. l. c., t. 354, not Sprengel. *Webera commutata,* Schimp. Syn. 2 ed. 403.

On Mount Dana, at 9–10,000 feet altitude (*Bolander*); Cascade Mountains, Washington Territory (*Lyall*); Europe.

8. **B. Tozeri**, Grev. Stems clustered, 3 to 5 lines high, reddish: lower leaves remote, obovate, the upper more crowded, long-decurrent, broadly obovate, acuminate, entire, costate to the middle, with loose areolation, surrounded by a narrow reddish border; on the branches more or less regularly unequal: capsule pendulous on an arcuate pedicel, obovate or pyriform, symmetrical, with broad-conical operculum and double annulus: teeth yellowish, the inner thin and hyaline. — Scot. Crypt. Fl. t. 285; Bruch & Schimp. l. c., t. 353; Wilson, l. c., t. 50; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 272. *Webera Tozeri*, Schimp.

Borders of ditches and roads about San Francisco, Oakland, etc., *Bigelow*, *Bolander*. European.

9. **B. albicans**, Bridel. Loosely cespitose, pale glaucous-green; stems ½ to 3 inches high, erect or decumbent, reddish or dark purple: lower leaves remote, ovate-acuminate, the upper long-lanceolate, serrate above, spreading: male flowers discoid: capsule inclined or pendulous, short-pyriform, green, at length brown, subglobose when dry, with small operculum and no annulus: teeth large, orange. — Wilson, Eng. Bot. Suppl. t. 2836. *B. Wahlenbergii*, Schwaegr. Suppl. t. 70; Bruch & Schimp. l. c., t. 354; Wilson, l. c., t. 47; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 275. *Webera albicans*, Schimp.

In Dardanelles Cañon, and a more slender form on rocks watered by springs near San Francisco (*Bolander*); East Humboldt Mountains, Nevada, and in the Wahsatch (*Watson*); Galton Mountains (*Lyall*); also European.

§ 2. *Stems mostly innovating from the summit: leaves broader, with rhombic-hexagonal areolation: capsule pyriform: inner teeth interruptedly dehiscent; ciliolæ when present transversely appendiculate at the joints.* — BRYUM proper.

* *Inner peristome more or less adherent to the outer: ciliolæ often imperfect or none: flowers bisexual and polygamous: leaves cuspidate, costa excurrent.*

10. **B. arcticum**, Bruch & Schimp. Stems loosely cespitose, 3 or 4 lines high or more, purplish: leaves at length reddish, below ovate-lanceolate, the upper ovate-oblong, acuminate, with revolute margins and ferruginous border: capsule pendulous, clavate-pyriform, slightly incurved, pale brown with reddish mouth, small yellow conic-mamillate operculum, and broad annulus: peristome small, the inner adherent to the teeth, with very short ciliolæ. — Bryol. Eur. t. 335. *Pohlia arctica*, R. Brown; Schwaegr. Suppl. t. 172.

On Mount Dana (*Bolander*); Greenland to Labrador, and in Europe.

11. **B. cernuum**, Bruch & Schimp. Densely cespitose; stems branched, with numerous rhizoids: upper leaves densely crowded, rather rigid, erect-spreading, ovate-lanceolate, carinate-concave, the narrowly bordered margin somewhat reflexed, serrate above or entire: capsule pendulous, ovate- or oblong-pyriform, with small persistent apiculate-conic operculum and broad annulus: inner peristome adherent to the outer, the processes and long ciliolæ only partially free. — Bryol. Eur. t. 331; Wilson, l. c., t. 48; Fl. Dan. xv, t. 2613, fig. 2. *Cynodontium cernuum*, Hedw. Musc. Frond. t. 9. *B. pendulum*, Schimp.

On Mount Dana (*Bolander*); West Humboldt Mountains, Nevada (*Watson*); Arctic America to the northern Atlantic States, and throughout Europe.

12. **B. inclinatum**, Bruch & Schimp. Resembling the last; usually less tufted and shorter: leaves more reflexed and usually more broadly margined: operculum a little broader and less acute, sooner deciduous: inner teeth of the peristome free and ciliolæ only rudimentary. — Bryol. Eur. t. 334; Wilson, l. c., t. 49. *Pohlia inclinata*, Swartz; Schwaegr. Suppl. t. 63.

On rocks at Clark's, Yosemite Valley (*Bolander*); rocks and streambanks, East Humboldt Mountains, Nevada (*Watson*); Arctic America, and throughout Europe.

13. **B. Warneum**, Bland. Loosely tufted, simple or sparingly branched, with numerous rhizoids, the innovations more or less flagelliform: leaves spreading, ovate-

or oblong-lanceolate, narrowly bordered and lower margin slightly reflexed, serrate above: flowers rarely bisexual: capsule pendulous upon a strict pedicel, obovate-pyriform, brown; operculum small, convex, apiculate, persistent: inner membrane adherent to the orange-colored teeth, the very narrow yellowish processes free, and ciliolæ rudimentary. — Bruch & Schimp. l. c., t. 340; Wilson, l. c., t. 12. *Pohlia Warenensis*, Schwaegr. Suppl. t. 236.

Streambanks on Mount Dana, at 9 – 10,000 feet altitude, abundant (*Bolander*); European.

14. **B. uliginosum**, Bruch & Schimp. Stems cespitose, shortly branched, 3 to 7 lines high, with numerous rhizoids: leaves dull green, oval-lanceolate (the lower ovate), narrowly bordered, obtusely serrate above, the lower margin reflexed: flowers rarely bisexual: capsule horizontal or inclined upon a long arcuate pedicel, long-pyriform, somewhat incurved, with minute oblique orange-colored operculum and broad annulus: inner teeth fissured nearly the whole length, ciliolæ none or imperfect. — Bryol. Eur. t. 335, Wilson, l. c., t. 48.

On Monte Diablo (*Dr. Gibbons*); northern Atlantic States; Europe.

* * *Inner peristome free, the basal membrane long-produced; ciliolæ short or wanting: leaves ovate, costa not excurrent. Monœcious.*

15. **B. calophyllum**, R. Brown. Loosely cespitose; stems short, simple or branched, with few rootlets: leaves erect-spreading, somewhat succulent, round-ovate, strongly concave, entire with flat margins, without border, and the costa ceasing at or below the obtusish apex: capsule pendulous on a rigid strict pedicel, short-pyriform, with broad persistent apiculate-convex operculum. — Wilson, l. c., t. 33. *B. latifolium*, Bruch & Schimp. l. c., t. 339.

Santa Barbara (*W. L. Foster*); Arctic America; Northern Europe.

* * * *Inner peristome free, the basal membrane long-produced, and ciliolæ (2 to 4) equalling the inner teeth.*

+– *Flowers bisexual, rarely polygamous: leaves mostly long-cuspidate with the excurrent costa.*

16. **B. intermedium**, Bruch & Schimp. Cespitose, bright green, very fertile, the sterile branches elongated and flagelliform; stems 2 to 6 lines high, densely radiculose below: lower leaves ovate-, the upper oblong-lanceolate, with subrevolute margins and long remotely toothed cusp, loosely imbricated: capsule horizontal or inclined, oblong-pyriform with long collum, slightly incurved, not contracted below the narrow orifice, reddish brown; operculum persistent, acute: annulus separating in fragments. — Bryol. Eur. t. 356; Wilson, l. c., t. 49; Fl. Dan. xiv, t. 2381, fig. 1. *Webera intermedia*, Schwaegr. Suppl. t. 75.

Crescent City, Del Norte County (*Bolander*), and at various localities in the Sierra Nevada (*Bigelow, Brewer, Bolander*); mountains of Nevada (*Watson*); from Arctic America to the Atlantic States and New Mexico and throughout Europe. Resembling *B. pallescens*, from which it may be known by the bisexual flowers and characters of the capsule.

17. **B. cirrhatum**, Hornsch. Distinguished by the broader obovate- or obconic-pyriform pendulous capsule symmetrical and at length contracted below the broader orifice; annulus separating spirally. — Bruch & Schimp. l. c., t. 357.

In a meadow near the Calaveras Grove, and in Mono Pass (*Bolander*); Europe. Intermediate between *B. intermedium* and *B. bimum*.

18. **B. torquescens**, Bruch & Schimp. Distinguished by the much twisted leaves (when dry), ovate to oblong-lanceolate, entire, with a smooth cusp and very narrow border, the lower cauline and branch leaves long-lanceolate with reflexed margins: capsule larger, obconic, inclined or pendulous, usually incurved, with acutely apiculate purple operculum. — Bryol. Eur. t. 358; Wilson, l. c.

Oakland (*Bigelow*); East Humboldt Mountains (*Watson*); New York and Texas; Europe, Africa, Australia and South America.

19. **B. provinciale**, Philib. Cespitose, bright green, the stems 2 inches long or more, sparingly branched : leaves densely rosulate, loosely imbricated and not twisted when dry, the outer obovate, shortly acuminate, cuspidate with the excurrent stout red costa, concave, margins below recurved, minutely serrate at the apex ; inner leaves narrower, more acuminate, margins more revolute : capsule long-obconic, pendulous upon a red pedicel, orange-red ; operculum convex : teeth yellow ; ciliolæ strongly appendiculate. — Schimp. Syn. 2 ed. 432. *B. Billarderii*, Bruch & Schimp. l. c., t. 336. *B. Canariense*, Schimp. Syn. 1 ed., not Brid.

Cañon on Monte Diablo (*Bolander*) ; Europe.

B. BIMUM, Schreb., has been collected in the East Humboldt Mountains, Nevada (*Watson*), and in Washington Territory (*Lyall*), as well as in British America, the northern Atlantic States, Europe and South America. Stems ½ to 2 or 3 inches high, matted with red rhizoids, yellowish green above, dark brown below : leaves spreading, elliptic to oblong-lanceolate, shortly cuspidate, with rather broad margin and serrate above : capsule as in *B. cirrhatum*. Also resembling *B. pseudotriquetrum*. — Bruch & Schimp. l. c., t. 363 ; Wilson, l. c., t. 49 ; Sulliv. in Gray's Man. 2 ed. t. 4.

B. OREGANUM, Sulliv. (Musc. Wilkes Expl. Exped. 10, t. 7), is densely cespitose, 4 or 5 lines high, with very short bud-like innovations : leaves densely crowded, oblong or obovate-oblong, acute, serrate above, margins reflexed and narrowly bordered, costa reaching the apex ; perichætial leaves long-oblong, acuminate, with excurrent costa : capsule subpendulous, elavate-oblong, straight or slightly curved, constricted below the mouth when dry ; operculum rather small, hemispherical, apiculate : inner teeth broad, widely gaping, the ciliolæ in pairs and conspicuously appendiculate. — Oregon, *Pickering*.

+ + *Flowers monœcious : costa excurrent.*

20. **B. subrotundum**, Bridel. Stem much branched, with short bud-like innovations : lower leaves minute, ovate-acuminate, the upper densely imbricated, broadly ovate- or oblong-lanceolate, concave with flat margin, shortly awned, becoming with age reddish brown with blackish costa : capsule inclined or subpendulous, brown, round- or rarely oblong-pyriform, slightly contracted below the small orifice when dry ; operculum minute, mamillate : peristome ferruginous at base, pale yellow above. — Bruch & Schimp. l. c., t. 361. *B. pallescens*, var. δ, same, l. c., t. 360.

On rocks, Yosemite Valley (*Bolander*); British America (*Drummond*) ; Europe.

B. PALLESCENS, Schwaegr., may be distinguished by its rather narrower and less concave leaves with revolute margins, reddish at base, and the elavate-pyriform capsule with long collum, becoming contracted below the mouth, yellowish, at length reddish brown ; stems 1 or 2 inches high. — Suppl. t. 75 ; Bruch & Schimp. l. c., t. 359 ; Wilson, l. c., t. 48. In Washington Territory and the Wahsatch ; Arctic America to the northern Atlantic States, and in Europe.

+ + + *Flowers diœcious ; male flowers bud-like.*

++ *Costa more or less excurrent.*

21. **B. cæspiticium**, Linn. Cespitose, pale green and somewhat sericeous, ferruginous and tomentose below ; stems 3 to 12 lines long : lower leaves minute, lanceolate, the upper loosely imbricated, ovate- to oblong-lanceolate, long-cuspidate, concave, margins entire, reflexed : capsule brown, inclined or pendulous, oblong- or elongated-pyriform with broad mamillate yellow operculum : peristome ferruginous, inner teeth broadly fissured. — Engl. Bot. t. 1904 ; Bruch & Schimp. l. c., t. 374, 375 ; Wilson, l. c., t. 29 ; Fl. Dan. t. 2565.

In the Sierra Nevada, in several localities (*Brewer, Bolander*) ; West Humboldt Mountains, Nevada, and in the Wahsatch (*Watson*) ; Washington Territory (*Lyall*) ; Arctic America to the Atlantic States ; South America and the Old World.

B. ATROPURPUREUM, Weber & Mohr, is a similar species, with more shortly apiculate and more loosely areolate leaves, the capsule oval with a turgid abruptly contracted collum, pendulous on an arcuate pedicel, red becoming dark purple, with a broad prominently convex apiculate pale-purple operculum. — Bruch & Schimp. l. c., t. 378 ; Wilson, l. c., t. 50. It occurs in the mountains of Nevada (*Watson*), as well as in the Atlantic States, Europe and Africa.

22. **B. capillare**, Linn. Cespitose, bright or dull green, brownish and brown-tomentose below : stems 3 to 12 lines high, sparingly branched with more or less

slender innovations: leaves strongly twisted when dry, more or less spreading, oblong-obovate, abruptly acuminate with a rather long remotely serrulate apex, plano-concave with reflexed margin and yellowish border: capsule more or less pendulous or inclined, oblong-pyriform or subclavate, reddish brown, slightly contracted below the mouth when dry; operculum reddish, large, apiculate. — Schwaegr. Suppl. t. 74; Engl. Bot. t. 2007; Bruch & Schimp. l. c., t. 368; Wilson, l. c., t. 29; Fl. Dan. t. 2685.

On Monte Diablo (*Dr. Gibbons*); Vancouver Island (*Lyall*); Wahsatch Mountains (*Watson*); Alleghanies; Europe. A very variable species.

23. **B. occidentale,** Sulliv. A very similar and variable species, with slender innovations thickened in the middle: leaves erect, appressed, not twisted, elliptic to oblong-lanceolate, acuminate and long-cuspidate, margin scarcely recurved and without border: capsule much contracted when dry. — Pacif. R. Rep. iv. 188, t. 7; Sulliv. & Lesq. l. c. 2 ed. n. 283, 284; Lesq. in Mem. Calif. Acad. i. 24. *B. obconicum*, Sulliv. & Lesq. l. c. 1 ed. n. 187[b]. *B. Bauери*, Hampe, Linnæa, xxx. 457.

Very common on the ground, rocks, old logs, etc., *Bigelow, Brewer, Bolander.* Referred to the last species by James (Bot. King Exp. 406), and doubtfully by Lesquereux, l. c.

24. **B. obconicum,** Hornsch. Also closely resembling *B. capillare*, but the paler leaves more gradually acute and never obovate or narrower at base, erect and not twisted or but slightly so when dry, the yellowish bordered margin reflexed only toward the base: capsule pendulous, long-obconic and attenuate into the pedicel, with hemispherical operculum. — Bruch & Schimp. l. c., t. 367; Wilson, l. c., t. 49.

Santa Cruz Mountains, at 2,000 feet altitude, *Brewer.* Europe.

B. PALLENS, Swartz. Has been collected in Oregon (*Hall*); resembling *B. uliginosum*, but with dioecious flowers and perfect peristome, the operculum much larger, and reddish leaves with slightly thickened reflexed margins. — Musc. Succ. t. 4; Schwaegr. Suppl. t. 72; Bruch & Schimp. l. c., t. 373; Wilson, l. c., t. 29.

++ ++ *Costa ceasing at or below the apex.*

25. **B. argenteum,** Linn. Irregularly cespitose, greenish white, silvery-silky when dry: stems 3 to 12 lines long, fragile, very radiculose, with slender julaceous branches: lower leaves ovate, abruptly apiculate, the upper oblong-lanceolate, all deeply concave, entire, loosely areolate, the margin flat and costa ceasing above the middle: capsule pendulous, oblong, red becoming blackish and constricted below the mouth; operculum convex: teeth orange, paler above, on drying incurved among the erect cilia. — Smith, Engl. Bot. t. 1602; Bruch & Schimp. l. c., t. 384; Wilson, l. c., t. 29; Fl. Dan. xiv, t. 2381, fig. 2.

Near San Francisco (*Bolander*); in southern part of the San Bernardino Range (*Bigelow*); Carson City (*Watson*); Arctic America to the Atlantic States, and found in nearly all quarters of the globe.

26. **B. Californicum,** Sulliv. Densely cespitose; stem and innovations very short and budlike: leaves concave, subquadrate-ovate, shortly apiculate, with flat entire margin, the costa ceasing at the apex: capsule pendulous, dark-red, oblong or oblong-ovate, the collum as thick, obtuse at base and rugose when dry; operculum minute, hemispherical: teeth pale purple, remotely jointed, with solitary short unappendaged ciliolæ. — Pacif. R. Rep. iv. 188, t. 6; Sulliv. & Lesq. l. c. 2 ed. n. 292.

Near Benicia (*Bigelow*), and common around San Francisco (*Bolander*).

27. **B. Bigelovii,** Sulliv. Loosely cespitose; stem 1 or 2 inches high, very slender, several times innovating from the apex: leaves dark yellowish green, the lower small and distant, the upper larger, imbricate, erect-spreading, oblong-ovate, the uppermost lanceolate and acuminate, concave, margins scarcely recurved and nearly entire, the stout costa ceasing at or below the apex: capsule subpendulous,

oblong- or elliptic-pyriform, not contracted below the throat when dry; operculum rather large, convex-conic, stoutly apiculate. — Pacif. R. Rep. iv. 187, t. 5.

Banks of streams above Sonora, Tuolumne County, *Bigelow*. Considered by Sullivant as most nearly resembling *B. albicans*.

28. **B. miniatum**, Lesq. Densely cespitose, purplish and abruptly crimsoned at the ends of the branches; stems slender, simple or several times branched, the innovations sometimes very slender and filiform: leaves appressed when dry, loosely imbricated, the upper crowded into a head, concave, ovate or ovate-lanceolate, obtuse, margin scarcely reflexed and scarcely or not at all bordered, the stout costa ceasing below the apex, areolation polygonal, thick-walled: capsule inclined, elongated obconic, somewhat contracted below the mouth when dry, reddish, with reddish mamillate operculum. — Mem. Calif. Acad. i. 23.

Moist rocks, Yosemite Valley, *Bolander*. Resembling the last, but with longer capsule and shorter obtuser leaves.

29. **B. Atwateriæ**, Muell. Stems stout, more or less elongated, in compact tufts bright scarlet or yellowish above: leaves erect, closely imbricated, ovate or suborbicular, strongly concave, very obtuse and subcucullate at the apex, entire, scarcely or not at all bordered; areolation rather close, rhombic, below subquadrate: capsule horizontal or subpendulous, narrowly elliptical upon a rather long collum, deep red; operculum conic, acutish: peristome red. — Flora, lviii. 76. *B. Macounii*, Austin, Coult. Bot. Gazette, ii. 110.

On wet rocks at Yosemite Falls (*Mrs. Atwater*); Oregon (*Hall*); Vancouver Island, *Macoun*.

+ + + + *Flowers dicœious; male flowers subdiscoid: costa continuous to the acute apex.*

30. **B. Duvallii**, Voit. Loosely and very softly cespitose, becoming bright purple or purplish green; stem elongated, at length decumbent, slender, with long and very slender branches, rooting only at base: leaves remote, spreading, subequal, broadly ovate-lanceolate, long-decurrent, nearly flat, entire, loosely areolate, much contracted and curved when dry: capsule pendulous, brown, obovate-oblong, symmetrical, contracted below the mouth when dry; operculum mamillate. — Schwaegr. Suppl. t. 79; Bruch & Schimp. Bryol. Eur. t. 371; Fl. Dan. t. 2684.

Eureka (*Bolander*); East Humboldt Mountains, Nevada (*Watson*); Fort Colville, Washington Territory (*Lyall*); Newfoundland and the White Mountains; Europe.

31. **B. pseudotriquetrum**, Schwaegr. Widely cespitose, olive- or brownish-green; stems erect, sparingly branched, 1 to 3 (or 6) inches high, tomentose: leaves gradually enlarging upward and more crowded, more or less spreading, incurved or twisted and rigid when dry, subdecurrent, elliptic- to oblong-lanceolate, serrulate at the apex, margin reflexed with yellow border, rather narrowly areolate: capsule inclined, rarely pendulous, long-obconic, frequently incurved, constricted when dry; operculum mamillate. — Bruch & Schimp. l. c., t. 364; Wilson, l. c., t. 30. *Mnium pseudotriquetrum*, Hedw. Musc. Frond. iii, t. 7.

On wet rocks, Calaveras Grove (*Bolander*); Fort Colville (*Lyall*); Ohio; Europe. Very variable. Pedicel in the taller specimens 3 inches long.

32. **B. turbinatum**, Schwaegr. More or less densely cespitose, pale green or reddish; stems ½ to 3 inches high, simple or sparingly branched: leaves below ovate, concave, the upper crowded, oblong-ovate to long-lanceolate, obsoletely serrate at the apex, the very narrowly bordered margin reflexed: capsule pendulous, thick-pyriform, much constricted below the broad mouth when dry; operculum convex, apiculate: peristome large, yellowish, the ciliolæ long-appendiculate. — Bruch & Schimp. l. c., t. 373; Wilson, l. c., t. 48.

Var. **latifolium**, Bruch & Schimp. Stouter and taller, with the bright green leaves 2 or 3 times larger, more concave and not carinate, the flat or slightly recurved

margin more narrowly bordered, and the areolation more loose. — *B. Schleicheri*, Schwaegr. Suppl. t. 73; Schimp. Syn. Musc. 2 ed. 462.

Wet meadows, Calaveras Grove (*Bolander*); mountains of Nevada and Utah (*Watson*); Galton Mountains (*Lyall*); Rocky Mountains of British America to Colorado and the northern Atlantic States; Europe and Asia. The variety, which Schimper now separates as distinct, in the mountains from the Sierra Nevada to Colorado.

34. MNIUM, Linn.

Larger, with simple or rarely divided annual naked or tomentose stems, perpetuated by basal innovations or stolons. Leaves in several ranks, the lower usually remote, minute, at the flowering summit much larger and rosulate, shining, broadly obovate to oblong from a narrow rarely subclasping or decurrent base, with stout costa and the usually thickened bordered margin entire or mostly serrate with 1 to 3 rows of firm teeth; areolation round-hexagonal, at base hexagonal-oblong and paler. Flowers diœcious or bisexual, the male discoid with very numerous axillary antheridia and clavate paraphyses. Calyptra cucullate, very narrow, smooth, fugaceous. Capsules inclined or pendulous on long usually strict often clustered pedicels, ovate or oblong or subglobose, with short abrupt collum; operculum convex, mamillate or more or less beaked; annulus narrow. Peristome as in *Bryum*, the inner membrane reaching to the middle of the paler outer teeth; ciliolæ present in twos or threes, filiform, not appendiculate.

About 25 species are known, almost entirely European and North American.

* *Flowers diœcious.*

\+ *Leaves serrate.*

1. **M. affine**, Bland. Broadly cespitose; stolons often very long; stems 1 to 3 inches high: leaves spreading, recurved and crisped when dry, the lower round-obovate, the middle obovate-oblong, the upper large, oblong-elliptic or lingulate, all long-decurrent and more or less abruptly acuminate and shortly cuspidate with the excurrent costa; border narrow, yellowish, acutely toothed: capsule (often 2 to 4 from the same flower) oblong, glaucous-green, at length brownish; operculum apiculate, yellow. — Bruch & Schimp. Bryol. Eur. t. 397; Wilson, Bryol. Brit. t. 51; Berkeley, Brit. Moss. t. 17, fig. 2.

Var. **elatum**, Schimp. More densely cespitose, taller and more slender, with erect stolons often exceeding the capsules: leaves with a pale border, the teeth more remote and shorter: capsule usually solitary and shorter. — Syn. 2 ed. 476. *M. insigne*, Mitt. in Hook. Journ. Bot. viii. 230; Sulliv. Icon. Musc. Suppl. 53, t. 37.

On stream banks in Devil's Cañon (*Bolander*); East Humboldt Mountains, Nevada (*Watson*); Puget Sound and north to Sitka, and frequent in Canada and the Atlantic States; Europe. The variety in swampy places, near Clear Lake (*Bolander*); British Columbia, and in Europe.

2. **M. Menziesii**, Muell. Stems erect, 3 inches high or more, strict, with numerous spreading branches (an inch long) at the summit: leaves appressed, the lower remote and scale-like, the upper and those on the branches lanceolate, acute, somewhat concave, costate to the apex, not bordered, the margin and nerve upon the back acutely serrate; perichætial leaves long-acuminate with excurrent costa, serrate only at the apex: pedicels several or solitary; capsule cylindric-oval, pendulous, at length contracted below the broad mouth; operculum obtuse. — Syn. Musc. Frond. i. 177; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 306. *Hypnum acanthoneuron*, Schwaegr. Suppl. t. 258. *Bryum Menziesii*, Hook. Bot. Misc. i. 36, t. 19. *Rhizogonium acanthoneuron*, Muell. in Bot. Zeit. v. 803.

On shaded rocks and creek banks in the Coast Ranges (*Bigelow, Bolander*); at Port Discovery and Puget Sound, Washington Territory, *Menzies, Scouler, Pickering.*

+ + Leaves entire.

3. **M. punctatum**, Hedw. Loosely cespitose, dark green, reddish below; stems ½ to 4 inches high, tomentose, with several erect branches, not stoloniferous: leaves remote, spreading and reflexed, large, firm, round-obovate with a very narrow base, the upper more crowded, obovate-spatulate, slightly emarginate and very minutely apiculate, with thickened reddish margin, the purplish costa ceasing at or near the top: capsule more or less pendulous, mostly solitary, ovate, pale olive-brown; operculum acutely conic-rostellate. — Bruch & Schimp. l. c., t. 387; Wilson, l. c., t. 30; Berkeley, Brit. Moss. t. 17, fig. 6. *Bryum punctatum*, Schreb.; Smith, Engl. Bot. t. 1183.

Eureka (*Bolander*); Port Discovery (*Pickering*); Alleghany Mountains and northward, and European.

** * Flowers bisexual.*

+ Leaves bordered, simply serrate.

4. **M. venustum**, Mitten. Pale green; stems an inch or two high, rigid, with erect basal branches or simple, leafy: leaves erect-spreading, broadly elliptic, acuminate, cuspidate with the stout excurrent nerve, acutely serrate upon the narrow border; inner perichætial leaves narrowly lanceolate: capsule inclined or pendulous (pedicels clustered, an inch long), oblong, with a broad mouth, papillose, surrounded at base by a band of deep-colored stomata; operculum depressed-conic, short-acuminate. — Hook. Journ. Bot. viii. 231, t. 12, B; Sulliv. Icon. Suppl. 52, t. 36.

On shaded rocks, Ukiah, etc. (*Bolander*); Port Discovery (*Pickering*); Vancouver Island, *Menzies, Douglas, Lyall.*

M. Drummondii, Bruch & Schimp., was collected by *Hall* on the Columbia River. Stem simple, 1 inch high or more, with erect strict basal branches: leaves erect-spreading with the apex recurved, not crisped when dry, lanceolate-obovate, acuminate-apiculate, with a narrow thickened yellowish border, serrate above the middle with long acute soft teeth. — Lond. Journ. Bot. ii. 669; Sulliv. Icon. Musc. 83, t. 51. Rocky Mountains of British America to Canada and the White Mountains; also in Finland.

M. Nevii, Muell. (Flora, lvi. 481, and Torr. Bot. Bulletin, v. 5), is a similar species with leaves crowded at the summit of the stem, reflexed-spreading, when dry erect and slightly crisped, broadly ovate or orbicular with shortly acuminate usually reflexed apex, the broad yellow border fimbriate with long ciliform teeth; perichætial leaves small, lanceolate-acuminate, entire: capsule pendulous, cylindric-oblong, thickened at base; operculum hemispheric-conic, mamillate. — Portland, *Rev. R. D. Nevius.*

+ + Leaves bordered, the teeth in pairs.

M. spinulosum, Bruch & Schimp. l. c., t. 394, with obovate-oblong leaves, pale green, the reddish border with spinulose teeth in pairs, and capsules (2 to 6) oval-oblong with short-beaked orange-colored operculum and dark red peristome, was also collected by *Hall* on the Columbia River. European.

35. TIMMIA, Hedw.

Cespitose perennials, on the ground, the simple stem at length innovating at the summit, tomentose below. Leaves crowded, subequal, spreading from a sheathing base, long-lanceolate, smoothish, incised serrate above, the stout costa reaching the apex; areolation minute, round-hexagonal. Inflorescence terminal, monœcious, with bud-like flowers of both sexes contiguous, or dioecious with the male flowers subdiscoid and proliferous. Calyptra narrow, cucullate, smooth, subpersistent. Capsule long-pedicelled, horizontal or inclined, oblong and subpyriform; operculum convex, mamillate or depressed. Peristome double as in *Bryum*, the inner membrane reaching to the middle of the lanceolate teeth and the processes divided into 4 nodose-filiform cilia coherent or anastomosing toward the apex; ciliolæ none.

Three species are known, two European, both of which are found in North America, and a third in Thibet.

1. **T. megapolitana**, Hedw. Stems an inch high or more: leaves deep green, the base whitish, linear-lanceolate, concave, the sides inflexed when dry: flowers monœcious: calyptra often attached to the pedicel or rarely persistent on the capsule: cilia appendiculate. — Musc. Frond. i, t. 31; Bruch & Schimp. Bryol. Eur. t. 407; Fl. Dan. Suppl. t. 47; Sulliv. in Gray's Man. 2 ed. t. 3.

West Humboldt Mountains, Nevada, and in the Wahsatch and Uinta Mountains (*Watson*); from Arctic America to Washington Territory (*Lyall*), Colorado and the Atlantic States; doubtless to be found in California.

36. MEESEA, Hedw.

Densely cespitose perennials, in bogs and swamps, sparingly branched and innovating below the flowering apex, densely radiculose. Leaves in several ranks, linear- or long-lanceolate, somewhat clasping and decurrent, with stout costa ceasing at or below the apex; areolation minute, hexagonal-rectangular. Inflorescence various; male flowers discoid with clavate paraphyses. Calyptra narrow, cucullate, smooth, fugaceous. Capsule very long-pedicellate, erect-cernuous, clavate with a long collum, incurved, with small oblique mouth, convex-conic operculum, and narrow simple annulus. Peristome as in *Bryum*, but the outer teeth short and obtuse, the inner narrow and much longer, on a short basal membrane and without ciliolæ.

Four species are known, all European, and three of them also North American.

1. **M. uliginosa**, Hedw. Deep green, with a somewhat silky lustre, brown below; stems ½ to 1 inch high with as long erect fastigiate innovations: leaves gradually enlarging from the base upward, linear-lanceolate, obtuse, with entire revolute margins: flowers polygamous: capsule reddish brown, with depressed operculum and orange-colored peristome. — Musc. Frond. i, t. 1, 2; Bruch & Schimp. Bryol. Eur. t. 308; Wilson, Bryol. Brit. t. 28; Berkeley, Brit. Moss. t. 16, fig. 7.

In alpine swamps (*Bolander, Brewer*); East Humboldt Mountains, Nevada (*Watson*); Washington Territory (*Lyall*); from Arctic America to the northern Atlantic States and Colorado, and throughout Europe.

M. LONGISETA, Hedw., taller (3 to 8 inches high), with broader flat-margined leaves, bisexual flowers, and yellowish peristome, occurs in Oregon or Washington Territory (*Pickering*) and in the northern Atlantic States. — Musc. Frond. i, t. 21, 22; Bruch & Schimp. l. c., t. 309; Wilson, l. c., t. 28; Sulliv. in Gray's Man. 2 ed. t. 3.

M. TRISTICHA, Bruch & Schimp. l. c., t. 311, a still taller dicœcious species, with broader sharply serrate leaves in 3 ranks, was collected in Washington Territory by *Lyall*, and is also found eastward.

37. AULACOMNIUM, Schwaegr.

Cespitose perennials, on rocks or usually swampy ground; stems erect, tomentose, innovating at the summit, the branches occasionally naked (*pseudopodia*) and ending in globose heads of rudimentary leaves. Leaves oblong to linear-lanceolate, costate to the apex, with minute round-hexagonal thick-walled areolation, rather looser at base, often papillose. Flowers dicœcious or monœcious, terminal, the male discoid or bud-like, with clavate or filiform paraphyses. Calyptra cucullate, long-beaked, smooth. Capsule long-pedicelled, solitary, somewhat nodding, oblong or ovate-oblong with short distinct collum, striate, sulcate when dry; operculum convex, mamillate; annulus compound. Peristome as in *Mnium*.

Four species are known, all North American, and three of them also European.

1. **A. androgynum**, Schwaegr. In compact tufts, or the fertile more lax, yellowish green; stems scarcely an inch high; pseudopodia numerous: leaves linear-lanceolate, spreading, curved or twisted when dry, denticulate at the apex, shortly

papillose, margin recurved: flowers dicœcious, the male bud-like, 12-leaved: capsule oblong-cylindric, symmetrical, reddish brown, with broad operculum. —Suppl. t. 125; Bruch & Schimp. Bryol. Eur. t. 406; Wilson, Bryol. Brit. t. 28; Sulliv. & Lesq. l. c., n. 205[b] (2 ed. n. 309). *Mnium androgynum*, Linn.; Engl. Bot. t. 1238.

Common, especially on redwood stumps (*Bigelow, Bolander, Brewer*); East Humboldt Mountains, Nevada (*Watson*); Oregon (*Newberry*); Washington Territory (*Pickering, Lyall*); Tennessee; Europe.

2. **A. palustre**, Schwaegr. Larger (2 to 4 inches high), with longer broader and more papillose leaves: male flowers discoid: capsule ovate-oblong, somewhat incurved. — Suppl. t. 226; Bruch & Schimp. l. c., t. 405; Wilson, l. c.; Berkeley, Brit. Moss. t. 18, fig. 5. *Bryum palustre*, Swartz; Engl. Bot. t. 391.

Swamps near Mendocino (*Bolander*); Washington Territory (*Lyall*); Wahsatch Mountains (*Watson*); from Arctic America to the Atlantic States, frequent; Europe and Siberia.

38. BARTRAMIA, Hedw.

Cespitose perennials, on the ground or rocks, innovating at the apex and branching dichotomously or subverticillately; stems erect, tomentose. Leaves mostly dull glaucous-green, lanceolate and often elongated from a subclasping base, papillose both sides, serrate and costa excurrent; areolation minutely quadrate above. Inflorescence various. Calyptra small, cucullate, smooth, fugaceous. Capsule globose or nearly so, usually cernuous on a long straight solitary pedicel (sometimes short and curved), striate and sulcate when dry, with minute convex-conic operculum and no annulus. Peristome rarely single or wanting, usually double as in *Bryum*, the inner teeth upon a short basal membrane, cleft to the base, segments at length divergent; ciliolæ often present. Sporangium much smaller than the cavity, stipitate.

A genus of nearly 100 species, largely South American, rather sparingly represented in Europe and North America. Besides the following, four other species are found in the Atlantic States. The section *Philonotis* is retained as a genus by Schimper.

* *Stem dichotomous, the branches not fascicled: leaves narrowed from the base, setaceous: male flowers bud-like.* — BARTRAMIA proper.

\+ *Capsule erect, symmetrical: peristome simple or rudimentary.*

1. **B. stricta**, Brid. Leaves erect-spreading, strict, rigid and fragile when dry, lanceolate-subulate, minutely serrate, spinulose-awned, rough both sides: flowers bisexual: capsule ovate-globose upon a strict pedicel; operculum convex or mamillate: teeth saffron-colored, regular and entire, or sometimes irregular, erose on the margin and dehiscent. — Bruch & Schimp. Bryol. Eur. t. 316; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 256.

On moist rocks and ground near San Francisco (*Bolander*); Europe. Pedicels terete; Schimper describes the pedicels in the European form as obtusely tetragonal.

2. **B. Menziesii**, Hook. Broadly and loosely cespitose, bright green above; stems 2 or 3 inches high or more, simple or sparingly branched, brown-tomentose to beyond the middle: leaves appressed or somewhat spreading, lanceolate-subulate from an ovate base with reflexed margins, serrate, scabrous on the back of the stout excurrent costa: flowers dicœcious: pedicels lateral by innovation, ½ of an inch long, erect: capsule broadly ovate, pale red; operculum conic, obtuse: teeth lanceolate, irregularly jointed, sometimes rudimentary. — Musc. Exot. t. 67; Schwaegr. Suppl. t. 240; Sulliv. & Lesq. l. c., n. 259, 260; Sulliv. Icon. Musc. Suppl. 39, t. 26. *Glyphocarpa Baueri*, Hampe, Linnæa, xxx. 457.

On shaded rocks, common; first collected by *Menzies*. A form occurs on dry rocks (*Bauer, Bolander*) with slightly shorter leaves and somewhat longer capsule, the peristome usually wanting or marked by a thin more or less irregularly lacerated membrane.

\+ + *Capsule cernuous, incurved, with oblique operculum and double peristome.*

3. **B. ithyphylla,** Brid. Tufts more or less compact, bright yellowish green; stems ½ to 2 inches high: leaves erect-spreading or erect when dry, setaceous-subulate from a white shining sheathing base, coarsely serrate, scarcely broader than the costa: flowers bisexual: capsule spherical, when dry oblong, incurved and deeply sulcate; operculum broadly conic, blunt: reddish brown teeth horizontally closing the orifice when damp, twice longer than the yellow processes. — Engl. Bot. t. 1710; Bruch & Schimp. l. c., t. 317; Wilson, Bryol. Brit. t. 23; Berkeley, Brit. Moss. t. 16, fig. 1.

On Mount Dana, abundant (*Bolander*), the alpine form, with short stems and pedicels; Cascade Mountains, Washington Territory (*Lyall*); White Mountains, and throughout northern Europe and northern Asia.

B. POMIFORMIS, Hedw., growing in large glaucous green tufts 1 to 3 inches high, the long-lanceolate leaves crisped when dry and not sheathing, and monœcious with the male and female flowers contiguous, the teeth connivent into a cone when damp, has been found on the Columbia River (*Hall, Nevius*), and is common in the Atlantic States as well as in northern Europe and Asia. — Engl. Bot. t. 998 (and t. 1526, *B. crispa*); Schwaegr. Suppl. t. 58, 59; Bruch & Schimp. l. c., t. 319; Wilson, l. c.; Berkeley, l. c. fig. 2.

* * *Branches subverticillate or fascicled: leaves small, lanceolate, pellucid: flowers monœcious or diœcious, the male discoid when diœcious: peristome double.* — PHILONOTIS, Muell. (*Philonotis,* Bridel.)

4. **B. fontana,** Brid. Stems 1 to 6 inches high or more, in broad yellowish or glaucous green mats; branches interruptedly verticillate: leaves of two forms, the smaller ovate, obtusely acuminate, appressed, the larger ovate-lanceolate and shortly awned, spreading or secund, bisulcate at base, all serrate and very papillose: flowers diœcious; inner perigonial leaves obtuse, ecostate: capsule ovate-globose, with purple subulate-tipped teeth, the ciliolæ about equalling the processes. — Bruch & Schimp. l. c., t. 324; Wilson, l. c. *Bryum fontanum,* Swartz; Engl. Bot. t. 390. *Philonotis fontana,* Brid.

At Clear Lake, on wet rocks (*Bolander*), and apparently common in the Sierra Nevada; Fort Colville (*Lyall*); in the Rocky Mountains from British America to Colorado and Utah, and frequent in the mountains eastward. Found throughout Europe, in India, and Patagonia.

B. CALCAREA, Bruch & Schimp., is distinguished from the last by longer subfalcate secund leaves with thicker costa, the perigonial leaves longer, all acute and with a slender costa, the teeth of the peristome not subulate-tipped and the ciliolæ short. It has been found in the East Humboldt Mountains, Nevada, and in the Uintas (*Watson*), in the White Mountains and Alleghanies, and in Europe; chiefly in limestone districts. — Bryol. Eur. t. 325; Wilson, l. c., t. 52. *Philonotis calcarea,* Schimp.

39. CATHARINEA, Ehrh.

Densely clustered or cespitose perennials, on the ground; flowering stems erect, simple or branched, from a creeping rhizome. Leaves lanceolate or oblong, undulate, crisped when dry, not sheathing, the narrowly bordered margin acutely serrate, the narrow costa sparingly lamellate on the upper side, areolation very densely round-hexagonal. Flowers monœcious or diœcious, the male cup-shaped and proliferous from the centre. Calyptra cucullate, narrow, naked, spinulose at the apex. Capsule terete, cylindrical or oblong, slightly incurved, erect or cernuous on a long pedicel; operculum convex, long-beaked; annulus none. Peristome single, of 32 short rigid ligulate obtuse slightly incurved teeth, confluent at base, and adherent above to a membranous expansion of the summit of the columella closing the orifice of the capsule. — *Atrichum,* Beauv.

Nine species are described, four European, of which three are North American, one peculiar to North America and three to tropical America, and another at the Cape of Good Hope.

1. **C. Callibryon**, Ehrh. Stems erect, usually simple, 1 or 2 inches high; innovations from subterranean stolons: leaves elongated ligulate-lanceolate, the undulations hispid beneath and the narrow yellow border spinulose-serrate, the costa spinose toward the apex and bearing 2 to 6 narrow lamellæ: fertile flower terminal upon the prolongation of the axis of a male flower, 1 – 3-fruited: capsule long-cylindric, straight or arcuate, brownish red, the long-beaked operculum little shorter. — Beitr. i. 189. *Atrichum undulatum*, Beauv.; Bruch & Schimp. Bryol. Eur. t. 410; Wilson, Bryol. Brit. t. 10; Berkeley, Brit. Moss. t. 19, fig. 4. *Polytrichum undulatum*, Hedw. Musc. Frond. i. 43, t. 16, 17; Engl. Bot. t. 1220.

At Mission Dolores (*Bolander*); Port Discovery and Fort Nisqually, Washington Territory (*Pickering*); Fort Colville (*Lyall*); in the Atlantic States and Europe.

2. **C. angustata**, Brid. More slender than the last, with narrower more closely areolate leaves serrate only at the apex, the lamellæ more numerous: male and female flowers in separate tufts: capsule narrower, more erect, purple; operculum dark purple, with a shorter beak. — *Atrichum angustatum*, Bruch & Schimp. l. c., t. 411; Sulliv. in Gray's Man. 2 ed. t. 3. *Polytrichum angustatum*, Hook. Musc. Exot. t. 50.

On stream-banks, Santa Cruz Mountains (*Brewer*); common in the Atlantic States and in Europe.

40. OLIGOTRICHUM, DC.

With the habit of *Catharinea* (to which it is nearly allied), but smaller and more rigid. Leaves linear-lanceolate, remotely serrulate, not bordered, the dilated costa bearing numerous lamellæ. Calyptra sparingly villous with erect hairs. Capsule erect, long-pedicelled, ovate-oblong, terete or nearly so; operculum convex-conic, acuminate or long-beaked. Peristome of *Catharinea*.

About a dozen widely scattered species are known, of which one is peculiar to Europe and two to North America. This genus is united with *Catharinea* by Mueller, as a section; both genera were originally made upon the same species.

1. **O. Lyallii**, Lindb. Stout, cespitose, yellowish brown; stems 2 inches high or more, naked at base, fastigiately branched at the middle, very leafy above: leaves spreading from a broad clasping base, covered above with lamellæ, the incurved margin serrate from the middle to the apex; inner perichætial leaves convolute-ovate, shortly acuminate: calyptra fugacious: capsule oblong, somewhat contracted above and biplicate, at length rugose; operculum subulate-beaked. — Polytrich. 102; Sulliv. Icon. Musc. Suppl. 56, t. 40. *Polytrichadelphus Lyallii*, Mitten, Journ. Linn. Soc. viii. 49; Sulliv. & Lesq. Musc. Am.-Bor. Exsice. 2 ed. n. 322.

On Mount Dana, in Yosemite Valley, and around Clear Lake (*Bolander*); Clover Mountains, Nevada (*Watson*); Colorado (*Hall*); British Columbia, *Lyall*.

41. POGONATUM, Beauv.

Calyptra cucullate, covered by a dense coating of soft hairs attached to its apex and nearly or quite covering the capsule. Otherwise as *Oligotrichum*.

Some 30 or 40 species are referred to this genus, many of them South American. Seven species are found in North America, two of which are also European.

1. **P. alpinum**, Bridel. Loosely and irregularly cespitose; stems much elongated, decumbent at base, fastigiately branched above: leaves linear-lanceolate, sheathing, spreading and recurved or subsecund, dark dull green with whitish base, acutely serrate, spinulose on the back; lamellæ with reddish thickened margins: capsule usually cernuous, oval-oblong; operculum small, with long oblique beak. — Bruch & Schimp. Bryol. Eur. t. 418; Wilson, Bryol. Brit. t. 11. *Polytrichum alpinum*, Linn.; Hedw. Spec. t. 19; Engl. Bot. t. 1905.

Var. **brevifolium**, Schimp. Stem erect, with short densely crowded yellowish green leaves, and small globose or obovate-globose capsule. — *Polytrichum brevifolium*, R. Br. in Parry's Voy. Appx. Suppl. 294.

On Mount Dana, the variety, *Bolander*. The species occurs in the White Mountains and in alpine regions of Europe and northern Asia.

2. **P. contortum**, Lesq. Clustered or loosely cespitose, glaucous-green, brown beneath; stems 1 to 6 inches high, rooting at base, erect, simple or innovating above, loosely leafy: leaves linear-lanceolate, not sheathing, erect-spreading, twisted when dry, acutely serrate the whole length, sparingly spinulose near the apex on the back of the costa; lamellæ narrow, not thickened on the margin: capsule somewhat cernuous, ovate-cylindric, contracted toward the mouth when dry; operculum long-rostellate. — Mem. Calif. Acad. i. 27; Sulliv. Icon. Musc. Suppl. 58, t. 42. *Polytrichum contortum*, Menzies, Trans. Linn. Soc. iv. 78, t. 7, fig. 2; Schwaegr. Suppl. i. 325, t. 96. *P. dentatum*, Lesq. l. c., not Menz.

On clay banks in the dense shade of redwoods near Crescent City (*Brewer*); Oregon (*Hall*); Rocky Mountains (*Parry*); also by *Menzies*.

42. POLYTRICHUM, Dill.

Stout showy perennials, on the ground, innovations rhizome-like from the base of the stem, erect or ascending; stems erect, rarely dichotomous, triangular, purple, woody, the fertile proliferous from the centre of the discoid male flower. Leaves and calyptra as in *Pogonatum*, the lower leaves scale-like, the upper elongated and sheathing. Capsule mostly cernuous, horizontal when dry, long-pedicelled, oblong- or ovate-prismatic, 4- (rarely 6-) sided, with a discoid or subglobose apophysis separated from the capsule by a stomatose band. Peristome the same; teeth usually 64.

Of the dozen or more species seven are European, of which five are found in North America.

1. **P. piliferum**, Schreb. Loosely cespitose; stems rarely an inch high, rigid, simple, densely leafy at the summit: leaves glaucous-green and brownish, suberect, imbricated, long-lanceolate from an ovate sheathing base, with incurved entire margins and tipped with a long slender white more or less roughened awn: capsule tetragonal-ovate, pale chestnut-color, with depressed short-beaked operculum. — Engl. Bot. t. 1199; Schwaegr. Suppl. t. 153; Bruch & Schimp. Bryol. Eur. t. 422; Wilson, Bryol. Brit. t. 10; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 326. *P. lævipilum*, Hampe, Linnæa, xxx. 459, with smooth awn.

Rocky places above Sonora (*Bigelow*); on Monte Diablo (*Bolander*); Lassen's Peak (*Brewer*); Vancouver Island (*Lyall*); Uinta Mountains (*Watson*); from Arctic America to the northern Atlantic States, and widely distributed over the globe, usually in dry and sterile places. Variable in the length and roughness of the awn.

2. **P. juniperinum**, Hedw. Stems 1 to 6 inches high, rarely 2- or 3-parted above: leaves spreading or recurved when damp, with a short reddish awn, the costa rough on the back: capsule acutely quadrangular, reddish orange, at length brown; otherwise like the last. — Spec. t. 18; Engl. Bot. t. 1200; Bruch & Schimp. l. c., t. 423; Wilson, l. c.; Berkeley, Brit. Moss. t. 19, fig. 6.

Apparently common; Cajon Pass (*Bigelow*); Mount Brewer (*Brewer*); Yosemite Valley and plains around Mendocino (*Bolander*); in Washington Territory, Utah, and Colorado, and from Arctic America to the Atlantic States. Very widely distributed.

P. COMMUNE, Linn., has been collected in Oregon (*Hall*); a tall species (6 to 12 inches high), with flat spreading or recurved leaves serrate on the margins and back, and an oblong acutely quadrangular reddish-brown capsule, with abruptly apiculate operculum. — Engl. Bot. t. 1197; Bruch & Schimp. l. c., t. 425; Wilson, l. c.; Sulliv. in Gray's Man. 2 ed. t. 3. Atlantic States, Europe and Asia; in swampy ground.

P. FORMOSUM, Hedw., a similar species of Europe and the Atlantic States, also found by *Hall* in Oregon, may be known by its soft yellowish longer usually 6-angled capsule with less distinct apophysis and conical operculum. — Spec. t. 19; Bruch & Schimp. l. c., t. 420; Wilson, l. c., t. 46.

43. BUXBAUMIA, Haller.

Minute nearly acaulescent annuals or biennials, on the ground or decaying wood. Leaves few, ovate- to linear-oblong, nerveless, coarsely toothed and becoming fringed or lacerate, pale at base and reddish above, the areolation loose, oblong-hexagonal, without chlorophyll. Flowers diœcious, terminal, bud-like; antheridia 1 or 2. Calyptra small, conic-cylindric, obtuse, fugacious. Capsule very large, on a stout fleshy densely verrucose purple pedicel, obliquely semi-ovate, the upper surface flattened, the lower ventricose, firmer and darker colored, continuous into the cylindrical collum; operculum small, conic, obtuse. Peristome double, the outer of one or more series of delicate irregular teeth, surrounded by a narrower adherent annulus, the inner membranaceous, hyaline, 32-plicate, twisted into a truncate cone.

Of the three described species one is found through the temperate regions of Europe, Asia and North America, a second is European, and the third occurs in Java.

1. **B. aphylla**, Haller. Stem a minute bulb, nearly buried in the ground, the leaves resolved into hair-like processes: pedicel 7 to 10 lines high: cuticle surrounding the orifice of the capsule becoming revolute and lobed: outer peristome of a single series of unequal pale yellow teeth much exceeding the brownish annulus. — Engl. Bot. t. 1596; Bruch & Schimp. Bryol. Eur. t. 427, and vi, t. 641; Wilson, Bryol. Brit. t. 22; Sulliv. in Gray's Man. 2 ed. t. 3; Berkeley, Brit. Moss. t. 19, fig. 6; Fl. Dan. t. 2752, fig. 1.

Cascade Mountains (*Lyall*) and probably in California; Eastern States, Europe, and Asia.

44. FONTINALIS, Dill.

Floating perennials, with slender stems attached only at base, branching. Leaves 3-ranked, smooth, ovate or ovate-lanceolate, nerveless, entire, with linear- or narrow-rhombic areolation, subscarious and shining when dry. Flowers diœcious, bud-like, lateral upon the primary stem or secondary branches. Calyptra small, conic. Capsule immersed in the perichætium, sessile or subsessile, ovate to cylindrical, with conic operculum and no annulus. Peristome double, the outer of 16 linear teeth coherent at the apex in pairs and very hygroscopic, the inner of 16 alternate cilia united by slender crossbars and forming a more or less perfect tessellated cone.

Of ten known species seven are found in North America, three of them also European.

1. **F. antipyretica**, Linn. Stems 8 to 12 inches long or more, much divided: leaves broadly ovate, acuminate, entire, acutely carinate and somewhat folded, the lower margin of one side reflexed, at length splitting along the keel, yellowish-green becoming olive or blackish; upper perichætial leaves broadly oblong, rounded at the apex, usually lacerate, closely embracing the ovate or ovate-oblong olive-colored capsule: teeth dark purple, 26 – 30-jointed, nearly equalling the inner perfect blood-red cone. — Engl. Bot. t. 359; Bruch & Schimp. Bryol. Eur. t. 429; Wilson, Bryol. Brit. t. 22; Sulliv. in Gray's Man. 2 ed. t. 4; Berkeley, Brit. Moss. t. 3, fig. 2; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 333. *F. Californica*, Sulliv. in Pacif. R. Rep. iv. 189.

Var. **gigantea**, Sulliv. A large form with the more sparingly branched stems less bare below and the closely imbricated leaves very rarely blackish, the smaller capsule with a shorter obtuser operculum, the shorter teeth 18 – 20-jointed and the cilia united only toward the top. — Icon. Musc. 106, t. 66. *F. gigantea*, Sulliv., and *F. Eatoni*, Sulliv. (?), Musc. Am.-Bor. Exsicc. n. 224, 224^{c}.

In rivulets in the Coast Ranges north of San Francisco (*Bigelow*); swamps (*Bolander*); alpine lake near Silver Mountain (*Brewer*); Fort Colville (*Lyall*); northern Atlantic States and Europe. The variety in Ruby Valley, Nevada, and Utah (*Watson*), and in the eastern Atlantic States.

2. **F. Neo-Mexicana**, Sulliv. & Lesq. Stem 8 to 12 inches long, the numerous branches and branchlets elongated, naked below, rather rigid: leaves dull yellowish green, oblong-lanceolate, more or less folded, areolation linear; perichætial leaves obovate-oblong, abruptly long-cuspidate: capsule ovate-oblong: peristome red; teeth 20-jointed; inner cone perfect. — Musc. Am.-Bor. Exsicc. n. 224; Sulliv. Icon. Musc. Suppl. 76, t. 57. *F. antipyretica*, var., Sulliv. & Lesq. l. c. 2 ed. n. 334. *F. Mercediana*, Lesq. Mem. Calif. Acad. i. 28.

On rocks in Merced River (*Bolander*); New Mexico (*Wright*); Colorado, *Hall.*

F. LESCURII, Sulliv., an eastern species, has been found in Oregon, *Hall.* It is soft and flaccid, with the bright green leaves long-lanceolate and concave, the capsule short-cylindric, and the peristome granulose-papillose: teeth 20 – 25-jointed and the cilia not connected below.

45. DICHELYMA, Myrin.

Floating perennials, with slender stems attached only at base, remotely and subdistichously branched. Leaves 3-ranked, elongated, narrow, falcate and folded, with slender costa, more or less serrulate; areolation rhombic. Flowers diœcious, bud-like, lateral: perichætium very long, the inner leaves sheathing, nerveless. Calyptra dimidiate or cucullate. Capsule pedicellate, immersed or more or less exserted, oval or oblong; operculum conic-rostrate; annulus none. Peristome double, nearly as in *Fontinalis;* teeth less hygroscopic, dehiscing along the medial line; cilia longer than the teeth, connected by crossbars the whole length or only at the apex or wholly free.

The six species are all North American, two of them also European. It is doubtful whether any species has been collected in California. Sterile specimens of a moss found in King's and Kaweah Rivers (*Brewer*), and on Mount Dana and in swamps near Mendocino City (*Bolander*), which are referred by Lesquereux (Mem. Calif. Acad. i. 28) to *D. Swarzii*, Lindb., were considered by Austin to be a variety of *Hypnum exannulatum*. Schimper states (Syn. Musc. Eur. 2 ed. 559) that *D. Swarzii* is probably *Hypnum fluitans.*

D. FALCATUM, Myrin. Leaves crowded, falcate-secund, lanceolate-subulate, the costa ceasing at the apex or somewhat excurrent, nearly entire; the inner perichætial leaves very long, lorate: calyptra cucullate, clasping the pedicel: capsule oblong on a slender exserted pedicel, ferruginous; operculum as long or longer, acutely acuminate-conic: peristome bright red, the inner much exceeding the outer, tessellate throughout. — Bruch & Schimp. Bryol. Eur. t. 433. *Fontinalis falcata*, Hedw. Musc. Frond. iii, t. 24. *D. cylindricarpum*, Austin, Coult. Bot. Gazette, ii. 111. Columbia River, Oregon, *Hall.*

D. UNCINATUM, Mitten. More slender and somewhat more pinnate, the falcate-secund long-attenuate lanceolate leaves terminated by the excurrent nerve, which is smooth above the serrulate margins and denticulate only at the apex; perichætial leaves not twisted: calyptra not adherent to the pedicel: inner cone perfect, exceeding the teeth about one-fifth of their length. — Journ. Linn. Soc. viii. 44, t. 8. Fort Colville, Washington Territory, *Lyall.*

46. FABRONIA, Raddi.

Very small slender creeping perennials, on the trunks of trees or on rocks; branches erect, somewhat fascicled. Leaves bright or pale green, very thin, shining, ovate-lanceolate, filiformly acuminate, dentate or ciliate, scarcely costate; areolation very loose, rhombic, at the base quadrate. Flowers monœcious, lateral, bud-like. Calyptra cucullate, smooth. Capsule ovate-pyriform or subspherical, erect on a rather short pedicel, of loose undulate-quadrate cells, which are transversely rectangular at the mouth; operculum convex-conic or rostellate; annulus none. Peristome single, of 16 flat linear-lanceolate teeth, remotely jointed.

A genus of about 20 very widely scattered species. Of the five North American species the following is the only one that is also European.

1. **F. pusilla**, Raddi. Densely cespitose, the erect simple branches a line or two high: leaves yellowish green, spreading, irregularly laciniate-ciliate to below the

middle, nerveless : capsule subspherical, minute, with broad convex-conic operculum : teeth frequently bifid at the apex, incurved when moist, reflexed when dry. — Schwaegr. Suppl. t. 99 ; Bruch & Schimp. Bryol. Eur. t. 450, excl. fig. 6 ; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 375.

On the bark of trees, Oakland (*Bolander*) ; Southern Europe.

47. HOOKERIA, Smith.

Prostrate succulent deep-green and shining perennials, in springy places, loosely cespitose and irregularly branching ; branches flattened, ascending. Leaves large, complanate, obliquely imbricated and spreading laterally, ovate or rounded, obtuse or acuminate, bicostate or nerveless, with very loose round-hexagonal areolation. Flowers monœcious, lateral, bud-like. Calyptra conic-mitriform, lobed at base, smooth. Capsule ovate or elliptical, horizontal or cernuous, long-pedicellate ; operculum conic-rostrate ; annulus obscure or none. Peristome double ; the outer of 16 firm closely-jointed linear-lanceolate teeth ; the inner of 16 carinate processes, alternate with and equalling the teeth, upon a plicate basilar membrane ; ciliolæ none. — *Pterygophyllum*, Brid.

As understood by Mueller the genus includes over 70 species, chiefly of the Southern hemisphere. It is variously limited and divided by other authorities. In any case, however, the generic name must be retained for the typical species *H. lucens*, whatever other species may be united with it.

* *Leaves nerveless, entire.*

1. **H. acutifolia**, Hook. (*l*) Stem creeping, somewhat branched, an inch or two long : leaves ovate-oblong, acute, nerveless, entire : capsule oblong, horizontal upon a pedicel an inch long, brown ; operculum conic-rostrate : teeth reddish brown, the inner yellowish. — Schwaegr. Suppl. t. 163 ; Sulliv. in Gray's Man. 2 ed. 666 ; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 270 (2 ed. n. 401) ; Lesq. Mem. Calif. Acad. i. 29.

Deep Cañon, Monte Diablo (*Bolander*) ; Atlantic States. Fruit unknown, and the plant therefore referred with doubt to Hooker's species, which is otherwise known only from India.

H. LUCENS, Smith. Stems 1 to 3 inches long : lower leaves rounded, the upper broadly ovate-oblong, obtuse, entire : pedicel an inch long : capsule more or less cernuous, oval, chestnut-colored becoming blackish, the large yellow operculum long-beaked : peristome reddish, the inner processes dehiscent along the keel. — Trans. Linn. Soc. ix. 276 ; Engl. Bot. t. 1902 ; Wilson, Bryol. Brit. t. 27 ; Fl. Dan. Suppl. t. 49. *Leskea lucens*, Schwaegr. Suppl. t. 84. *Pterygophyllum lucens*, Brid. ; Bruch & Schimp. Bryol. Eur. t. 448. Oregon (*Hall*) ; Europe.

* * *Leaves costate, serrate.*

H. ANOMALA, Muell., was collected on the western coast by *Menzies*. It is more erect and branched, with dusky green foliage, the leaves more remote and spreading, broadly ovate-oblong, narrower toward the base, acutish, coarsely and remotely serrate, 1-nerved to the middle with an obscure shorter lateral nerve. — Syn. ii. 204. *Racopilum anomalum*, Schwaegr. Suppl. t. 278.

48. PTEROGONIUM, Swartz.

Secondary stems erect or ascending, the branches more or less fascicled, arcuate especially when dry. Leaves not complanate, bicostate at base. Calyptra sparingly hairy. Teeth of the peristome short-lanceolate ; processes short, scarcely reaching to the middle of the teeth, upon a broader basilar membrane. Otherwise as the preceding.

As limited by Schimper the genus includes only the following species.

1. **P. gracile**, Swartz. Yellowish green ; stems 1 or 2 inches high, the branches obtuse or filiform-attenuate : leaves closely imbricated, ovate and acute or ovate-

lanceolate and acuminate, serrate toward the apex, margins flat, the nerves scarcely reaching the middle of the leaf: capsule erect, on a pedicel 6 lines long, cylindrical, chestnut-colored; operculum conic. — Engl. Bot. t. 1085; Bruch & Schimp. Bryol. Eur. t. 461; Wilson, Bryol. Brit. t. 14; Fl. Dan. t. 2673; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 349. *Neckera gracilis*, Muell.

Var. **duplicato-serratum**, Lesq. Leaves unequally duplicate-serrate at the apex. — Mem. Calif. Acad. i. 30. *Leptohymenium duplicato-serratum*, Hampe, Linnæa, xxx. 460.

On rocks near the bay of San Francisco (*Pickering, Bigelow, Bolander*); throughout Europe.

49. PTERIGYNANDRUM, Hedw.

Stems with arcuate-prostrate somewhat fascicled slender branches, branching irregularly. Leaves erect-spreading or subsecund, crowded, ovate or elliptical, short-acuminate, concave, 1–2-nerved at base; areolation linear-flexuose, at the basal angles quadrate, and rhombic above. Flowers diœcious. Calyptra cucullate. Capsule long-pedicelled, erect, oblong. Peristome double, the inner processes short and imperfect upon a very narrow basal membrane, without ciliolæ. A single species.

1. **P. filiforme**, Hedw. Small, loosely cespitose, greenish or yellowish: leaves appressed when dry, papillose on the back, margins recurved, serrate at the apex, sometimes 1-nerved to the middle: pedicel 9 lines long: capsule pale brown, narrowly oblong; operculum obliquely conic-rostrate: peristome small, pale yellow, the inner very short and indistinct. — Musc. Frond. iv. 18, t. 7; Bruch & Schimp. Bryol. Eur. t. 460. *Pterogonium filiforme*, Schwaegr.; Wilson, Bryol. Brit. t. 14.

Var. Leaves cristate-serrate at the apex; the stouter nerve ceasing above the middle. — *Leptohymenium cristatum*, Hampe, l. c. 459; Lesq., l. c., so refers it.

On shaded rocks and trees (*Bigelow, Bauer, Bolander*); on the White Mountains and in Europe.

Climacium, Web. & Mohr, is another genus of this group of fasciculately branched mosses, readily distinguished by its erect tree-like habit. C. Americanum, Brid., of the Atlantic States and also found in Oregon (*Hall*), is 2½ or 3 inches high, with ovate-lanceolate leaves auricled at base and costate nearly to the apex, serrate above, with minute elliptical areolation: capsule cylindrical: peristome perfect, the processes on a very narrow membrane, equalling the teeth, dehiscent, without ciliolæ. — Sulliv. in Gray's Man. 2 ed. t. 5.

50. ANOMODON, Hook. & Tayl.

On trees or rocks, the secondary branches ascending or erect, sparingly and irregularly or somewhat fasciculately branched. Leaves very densely rough-papillose on both sides, not complanate, costate, areolation minute or punctiform. Calyptra naked. Capsule long-pedicellate. Peristome double, without ciliolæ, the processes shorter than the teeth. Otherwise as the preceding.

About 6 or 8 species, mostly of North America and Europe, placed in *Hypnum* by Mueller.

Leskea, Hedw., as understood by Schimper, is distinguished from *Anomodon* by its more prostrate habit, the primary stem leafy like the branches; flowers monœcious or diœcious. A single species, L. polycarpa, Ehrh., of the Atlantic States and Europe, which has been collected in Oregon, *Hall*. Its stem is 2 inches long or more, with ascending branches ½ to 1 inch high: leaves ovate-lanceolate, spreading or secund, margins recurved below, entire, the costa ceasing below the apex: flowers monœcious: capsule cylindrical, slightly curved: peristome whitish, the processes equalling the teeth. — Bruch & Schimp. Bryol. Eur. t. 470.

1. **A. Californicum**, Lesq. Loosely cespitose, brownish yellow, sparingly branched, slender: leaves imbricated in 4 ranks, spreading when damp, broadly ovate, half-clasping and decurrent, acute, the margin folded abruptly backward, carinate with a stout costa ceasing at the apex, the papillæ upon the auricles longer and spinose: fruit unknown. — Mem. Calif. Acad. i. 30.

On rocks, Monte Diablo, *Bolander*.

51. NECKERA, Hedw.

Rather large creeping perennials, on trees or rocks, the secondary stems erect or ascending or pendulous, pinnately branched. Leaves complanate, shining, scarious and scarcely costate, mostly undulate, ovate-lanceolate; areolation minute, linear-rhombic. Flowers lateral upon the secondary stems, diœcious, bud-like. Calyptra cucullate, naked. Capsule erect, shortly pedicellate, immersed or emergent, ovate, symmetrical; operculum conic-rostellate; annulus none. Peristome double, of 16 yellowish linear-lanceolate jointed teeth, connivent at the apex when dry, and as many alternate filiform carinate processes as long as the teeth, upon a short basilar membrane; ciliolæ none.

About 50 species, of which half a dozen are North American and also mostly European.

1. **N. Menziesii,** Drum. Broadly and loosely cespitose, yellowish green; primary stems very slender, flagelliform, the secondary 6 inches long or more, flattened, with short spreading branches often flagellately produced: leaves oblong-ligulate, obtusely apiculate, concave, the costa ceasing above the middle; perichætial leaves lanceolate, acuminate: capsule immersed on a short pedicel, oblong-oval, pale brown: inner processes rather stout, dehiscing along the keel. — Musc. Amer. n. 162; Muell. Syn. ii. 48; Sulliv. Icon. Musc. Suppl. 83, t. 62; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 395.

On shaded rocks in Yosemite Valley and in Russian Valley (*Bolander*); at base of trees near Crescent City (*Brewer*); Cascade Mountains, Oregon (*Newberry, Hall*); Fort Colville (*Lyall*); Rocky Mountains, British America, *Drummond.* Also in Switzerland.

2. **N. Douglasii,** Hook. Loosely cespitose; stems a span long or more, pinnately and bipinnately branched; branches elongated: leaves crowded, distichously flattened, oblong or sublanceolate, acute, nerveless, serrulate at the apex, pale green; perichætial leaves broadly ovate to long-acuminate, convolute: capsule a little exserted, oval; operculum long-rostrate. — Bot. Misc. i. 131, t. 35; Sulliv. & Lesq. l. c., n. 394.

On trees, Marin County and Mendocino City (*Bolander*); Columbia River (*Menzies, Douglas, Scouler*); Vancouver Island, *Wood.*

52. ANTITRICHIA, Bridel.

Resembling the last genus. Leaves spreading, not complanate nor undulate, ovate-acuminate, costate to the middle. Capsule exserted upon a short erect or curved pedicel. Inner peristome of 16 shorter subulate-filiform fugacious processes.

Only the following species are known.

1. **A. curtipendula,** Brid. Secondary stems ½ to 1 foot long, irregularly pinnately branched, not rooting: leaves broadly ovate-lanceolate, acuminate, ciliate-serrate at the apex, with recurved margins, sometimes with 3 to 5 short nerves at base, the central ceasing above the middle; areolation of very narrow subflexuous cells acute at each end: pedicel more or less flexuous; capsule oval-oblong; operculum obliquely conic-rostrate: processes a little shorter than the teeth. — Bruch & Schimp. Bryol. Eur. t. 469; Wilson, Bryol. Brit. t. 22; Sulliv. in Gray's Man. 2 ed. t. 4; Berkeley, Brit. Moss. t. 13, fig. 4. *Neckera curtipendula,* Hedw.; Engl. Bot. t. 1444.

Var. **gigantea,** Sulliv. & Lesq. Very stout, dark green, with broader secund-falcate leaves, and longer cylindrical capsule. — Musc. Am.-Bor. Exsicc. 2 ed. n. 356; Schimp. Syn. 2 ed. 577.

On Monte Diablo (*Bolander*); Oregon (*Pickering*); Vancouver Island (*Wood*); Atlantic States and Europe. The variety on trees at Redwoods, *Bolander.*

2. **A. Californica,** Sulliv. Near the last: branches shorter, densely leafy: leaves appressed when dry, rather shortly acuminate, entire or scarcely serrulate at the apex; areolation of shorter oval cells, nearly uniform throughout: capsule cylindric, reddish, on a shorter straight pedicel: teeth longer, minutely punctulate, the processes much shorter. — Lesq. Trans. Amer. Phil. Soc. xiii. 11; Sulliv. & Lesq. l. c., n. 357; Sulliv. Icon. Musc. Suppl. 79, t. 59. *A. curtipendula*, var. *Hispanica*, Schimp.

On shaded rocks and sandstone boulders, Oakland (*Bolander*); also European.

53. ALSIA, Sulliv.

Resembling the preceding. Branching stems often circinate when dry. Leaves smooth or papillose, the areolation minutely oval-rhombic and punctiform. Capsule cylindric, emergent or exserted; operculum conic, long-beaked. Peristome double, the inner processes shorter than the teeth, upon a narrow basal membrane, with or without ciliolæ. — Proc. Amer. Acad. iii. 184.

An American genus of three species, nearly allied to *Leptodon*, Weber (*Lasia*, Beauv.), and intermediate between *Neckera* and *Thuidium*.

* *Capsule very shortly pedicelled.*

1. **A. Californica,** Sulliv. On trees, in dark green masses; secondary stems 2 or 3 inches long, subpinnately branched, not circinate, somewhat arcuate, the branches short, slender, not crowded: leaves erect-spreading, ovate- or oblong-lanceolate, slightly serrulate at the apex, margins narrowly reflexed, costa ceasing below the middle, areolation minute and subrhombic, smooth; leaves on the branches smaller and narrower, the perichætial long and slender: capsule oblong-cylindrical, straight or slightly curved, scarcely exserted upon a short pedicel: inner processes a third shorter than the teeth; ciliolæ none or rudimentary. — Musc. Wilkes Exped. 25, t. 25; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. n. 268[b] (2 ed. n. 398). *Neckera Californica*, Hook. & Arn. Bot. Beechey, 162.

Very common along the coast, *Pickering, Bigelow, Bolander.*

2. **A. abietina,** Sulliv. On trees, in loose rigid deep green masses; secondary stems 2 to 5 inches long, simple below, expanded above into a pinnately or somewhat bipinnately branched frond, strongly circinate when dry: leaves erect-spreading, lanceolate, shortly papillose on the back above the middle, margins below recurved, serrulate and slightly inflexed above, the costa ceasing below the apex, areolation oval-rhombic, longer in the middle and quadrate at the angles: capsule ovate-oblong, emergent on a very short pedicel, ribbed when dry: peristome as in the last, but ciliolæ wanting. — Icon. Musc. 115, t. 72[b]; Sulliv. & Lesq. l. c. 2 ed. n. 400. *Neckera abietina*, Hook. Musc. Exot. t. 7; Schwaegr. Suppl. t. 140. *Pilotrichum abietinum*, Brid. *Leptodon circinatus*, Sulliv. in Pacif. R. Rep. iv. 189, t. 1.

Common in the Coast Ranges from south of San Francisco to Vancouver Island.

* * *Capsule long-pedicelled.*

3. **A. longipes,** Sulliv. & Lesq. Diffusely cespitose, grayish green; secondary stems 3 to 5 inches high, pinnately and bipinnately branched from the base: leaves oblong-lanceolate, acute, coarsely serrate above, margin slightly recurved, costa ceasing above the middle and denticulate on the back at its apex, areolation minutely oval, smooth; perichætial leaves abruptly filiform-attenuate: capsule cylindrical, upon a pedicel nearly an inch long, straight: teeth and processes very narrow, the latter a little shorter and dehiscent along the keel; ciliolæ (1 or 2) appendiculate. — Musc. Am.-Bor. Exsicc. 2 ed. 399; Lesq. in Mem. Calif. Acad. i. 29; Sulliv. Icon. Musc. Suppl. 85, t. 63.

On rocks in deep cañons, Oakland, *Bolander.*

54. HYPNUM, Dill.

Variable in habit and mode of growth; primary stem prostrate, the secondary stems irregularly and subfasciculately branched or more or less regularly once or twice pinnate. Leaves rather broad, mostly smooth and shining and more or less scarious, costa short or wanting or rarely percurrent; areolation mostly narrowly prosenchymatous, linear or flexuous-linear, rarely rhombic or hexagonal. Inflorescence various (more frequently dicœcious), lateral, bud-like. Calyptra dimidiate, smooth. Capsule long-pedicellate, more or less cernuous and unsymmetrical; operculum conic or rostrate. Peristome double as in the preceding genera, the inner upon a broader basal membrane (about half the length of the teeth), with cilioke.

A large and difficult genus of over 500 species, which is readily divisible into several more or less well-marked groups. Schimper proposes 20 or more genera for the European species, half of which are represented in the Californian flora, but it will be most convenient here to consider them only as subgenera or sections. The species are often of difficult definition and based upon apparently slight characters.

§ 1. *Ramification pinnate (excepting* n. 4): *leaves papillose, acuminate, costate to the apex, equally spreading: operculum conic.*

* *Pedicel scabrous or tuberculate: flowers dicœcious.*

1. **H. Whippleanum,** Sulliv. Stems filiform, 1 or 2 inches long, pinnately twice or thrice divided, arcuately prostrate, radiculose at the top, the numerous branchlets 3 to 5 lines long: leaves erect-spreading, ovate-lanceolate, papillose on the back, entire margin serrate, pellucid, costa reaching nearly to the apex, areolation quadrate oblong: capsule on a tuberculate pedicel 5 to 7 lines long, abruptly horizontal, oval or oblong, somewhat unequal, dark chestnut with blackish distinct obtuse collum; operculum constricted in the middle; annulus none: cilioke in pairs, equalling the processes and whitish teeth. — Pacif. R. Rep. iv. 190, t. 9; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 407.

On the ground in mountain cañons near the Bay of San Francisco, *Bigelow.*

2. **H. crispifolium,** Hook. Stems 4 or 5 inches long, branches slightly incurved, simply pinnate with short unequal branchlets: leaves crowded, bright green, erect-spreading, crisped when dry, lanceolate from a broadly cordate subdecurrent base, serrate, flexuose, narrowly long-acuminate or sometimes tipped with a hyaline hair, the pale costa ceasing below the apex, very finely papillose, areolation minute, rounded; perichætial leaves smooth with a very long and narrow denticulate acumination: pedicel short, very scabrous, purple: capsule horizontal, pale, incurved-oblong, broadly annulate; operculum obliquely beaked: processes broadly gaping or divided; ciliolæ 2 or 3, nearly as long. — Musc. Exot. t. 31; Lesq. in Trans. Amer. Phil. Soc. xiii. 11; Sulliv. & Lesq. l. c., n. 405. *H. ramulosum,* Hampe; Muell. Syn. ii. 486.

On shaded ground and rocks, near Oakland, and near Paper Mill, Marin County (*Bolander*); Oregon (*Nevius*); Vancouver Island, *Menzies, Wood.*

H. LAXIFOLIUM, Schwaegr. Suppl. t. 143 (*Leskea laxifolia,* Hook. Musc. Exot. t. 30), collected by *Menzies* and not since identified, appears to be a similar species, but with broader and less attenuate leaves, a shorter and more turgid capsule, the processes less dehiscent, and the ciliolæ very short and imperfect.

* * *Pedicel smooth.*

3. **H. calyptratum,** Sulliv. Very small; stem filiform, subsimply pinnate, flagelliform at the summit: leaves erect-spreading, broadly ovate, narrowly long-acuminate, denticulate, costate to the apex, sparingly papillose on the back, areolation minute and subquadrate: flowers monœcious: calyptra very long, embracing the pedicel: capsule cylindric, oblique, curved; operculum obtuse; annulus none:

processes nearly equalling the teeth; ciliolæ very short, solitary. — Pacif. R. Rep. iv. 190, t. 10.

On the ground, near Los Angeles, *Bigelow.*

4. **H. leuconeurum**, Sulliv. & Lesq. Low, rather densely cespitose, irregularly branched or the short branchlets subpinnately arranged, yellowish green and shining: leaves erect-spreading, ovate-lanceolate, narrowly acuminate, serrulate, costate to the apex, papillose, areolation minute, ovate-rhombic above, shorter and equilateral below; perichætial leaves nerveless, with a long subflexuous dentate acumination: flowers dioecious: capsule horizontal on a curved reddish pedicel, ovate-oblong with thick abrupt collum; operculum acute; annulus simple: processes equalling the teeth; ciliolæ much shorter, in threes. — Musc. Am.-Bor. Exsicc. 2 ed. n. 407[b]; Lesq. in Mem. Calif. Acad. i. 31. *Thuidium leuconeurum*, Lesq.; Sulliv. Icon. Musc. Suppl. 104, t. 80.

On trunks of *Quercus agrifolia* and on moist shaded hillsides, Oakland, *Bolander.* This species, together with the rest of the group and some other species, are referred by Lesquereux, l. c., to the section *Thuidium* (genus *Thuidium* of Schimper), from which they all seem to differ, however, in their stems not villous and without paraphyllia, the leaves homomorphous and rarely at all decurrent, the dissimilar areolation, and the fewer and mostly shorter ciliolæ. The only western species nearly conforming to *Thuidium* in most of these respects is H. Blandowii, Web. & Mohr (*T. Blandowii*, Bruch & Schimp. Bryol. Eur. t. 486), collected by *Lyall* at Fort Colville. This has a simply pinnate densely villous erect stem, the stem-leaves broadly ovate or subcordate, long-papillose on the back and villous at base, plicate, with rather loose elongated areolation, the branch-leaves ovate-acuminate: capsule oblong, strongly curved on a smooth pedicel 2 inches long; operculum acute.

§ 2. *Stems mostly prostrate: leaves smooth and shining, scarious, erect or spreading every way (or complanate in* Thamnium*), costate to the middle or rarely nearly to the apex.*

* *Operculum short-conic, often apiculate.*

+ *Branching pinnate or sometimes irregular: leaves plicate; areolation narrowly linear: flowers dioecious (male plants often parasitic on the female).* — Camptothecium. (*Camptothecium*, Schimp.)

++ *Pedicels rough.*

5. **H. lutescens**, Huds. Stem suberect, irregularly branched or subpinnate, 3 inches high or more: leaves long-lanceolate, acuminate, strict and rather rigid, plicate-striate, costa ceasing below the minutely serrate apex: capsule oblong-cylindric, slightly cernuous, subarcuate, brownish; operculum acute-conic. — Hedw. Musc. Frond. iv, t. 16; Engl. Bot. t. 1301; Wilson, Bryol. Brit. t. 25; Berkeley, Brit. Moss. t. 5, fig. 2. *Camptothecium lutescens*, Bruch & Schimp. l. c., t. 558.

California (*Coulter*); Victoria, Oregon (*Bolander*); Vancouver Island (*Lyall*); also collected by *Douglas.* European.

6. **H. Nuttallii**, Wils. Prostrate, broadly cespitose, bright yellow; stems 3 to 5 inches long, rather sparingly divided, pinnately branched, the numerous crowded branchlets 3 to 5 lines long, spreading or secund: leaves erect-spreading, strict, narrowly oblong-lanceolate, acuminate, more or less sulcate-striate, serrate, margin recurved, costa nearly reaching the apex, areolation very long and narrow: perichætial leaves filiform-attenuate, obsoletely costate: capsule long-cylindric, erectish, curved, on a very short rough pedicel; operculum short-beaked; annulus narrow: processes equalling the teeth; ciliolæ very short. — Bryol. Brit. 334, 339, in note; Sulliv. & Lesq. l. c., n. 338[b] (2 ed. n. 514); Sulliv. Icon. Musc. 211, t. 128. *Leskea Californica*, Hampe, Linnæa, xxx. 460. *Camptothecium Nuttallii*, Bruch & Schimp. l. c. vi. 6.

Var. **stoloniferum**, Lesq. Branches elongated, filiform, crowded: capsule shorter and more slender. — Mem. Calif. Acad. i. 32.

Common on trees (*Bigelow, Bauer, Bolander*); Vancouver Island, *Douglas, Lyall.*

7. **H. arenarium**, Lesq. Loosely and broadly cespitose; stem sparingly irregularly branched, the secondary branches short and erect, or longer, filiform and rooting: leaves crowded, erect, lanceolate, acuminate, the reflexed margin subserrulate, costa ceasing below the apex, areolation densely narrow, ovate-rounded and minute at base: capsule small, ovate-cylindric, cernuous on a long pedicel smoothish above. — Trans. Amer. Phil. Soc. xiii. 13; Sulliv. & Lesq. l. c. 2 ed. n. 512.

Covering the sand among bushes near the shore, San Francisco, *Bolander*.

8. **H. pinnatifidum**, Sulliv. & Lesq. Loosely cespitose, soft and pale green; stems slender, 3 inches long or more, prostrate, fragile, pinnately and densely branched; branches short or the upper flagelliform: leaves densely imbricated, lanceolate from an ovate subdecurrent base, subulate-acuminate, distinctly plicate, margin revolute, subdenticulate at the apex, costa ceasing above the middle, areolation linear-rhombic, quadrate at the auricles; perichætial leaves oblong, long-acuminate, nerveless: capsule oblong, subcernuous, slightly curved, annulate; operculum mamillate: processes equalling the teeth, the cilioke shorter. — Musc. Am.-Bor. Exsicc. 2 ed. n. 513. *Camptothecium pinnatifidum*, Sulliv. Icon. Suppl. 101, t. 77.

On shaded rocks in cañons, *Bolander*.

H. MEGAPTILUM, Sulliv. in herb. Loosely cespitose, whitish or pale green; stem stout, 6 inches high, erect, pinnately branched; branches short, horizontal: leaves crowded, erect, narrowly ovate-lanceolate, abruptly short-apiculate, concave, strongly plicate, costate to above the middle, denticulate upon the subrevolute margin and upon the back along the costa and folds; areolation long-linear, shorter in the alæ: capsule horizontal on a red pedicel, ovate-oblong, at length arcuate; operculum mamillate: cilioke in pairs, appendiculate, equalling the indehiscent processes and stout teeth. — *Camptothecium (?) megaptilum*, Sulliv. Icon. Muse. Suppl. 102, t. 78. On the ground in dense coniferous woods, Oregon, *Hall*.

H. PSEUDOSERICEUM, Muell. (Flora, xxxiii. 89), appears to belong to this group: procumbent, irregularly branched, flaccid and silky: capsule upon a very short pedicel, arcuate-cylindric, slightly inclined; operculum obliquely conic-rostellate: cilioke solitary or in pairs. — Portland, Oregon, *Nevius*.

++ ++ *Pedicels smooth: branching pinnate.*

9. **H. Nevadense**, Lesq. Loosely cespitose, stout, yellowish green; stem prostrate, pinnately branched, the branches short and horizontal or rather long, irregularly divided and arcuate: leaves lanceolate, short-acuminate, secund-curved, minutely serrate at the apex, carinate, deeply 2-plicate, margin revolute or reflexed, the alar cells very few and irregularly oval: capsule ovate-cylindric, erect or subcernuous; operculum long-beaked; annulus compound: cilioke rudimentary or wanting. — Mem. Calif. Acad. i. 33.

On rocks in the spray of Nevada and Bridal Veil Falls (*Bolander*); on sand and rocks in the Washoe and West Humboldt Mountains, Nevada, and in the Wahsatch, *Watson*.

+– +– *Ramification irregular, rarely subpinnate: leaves decurrent, mostly sulcate; areolation narrowly hexagonal-rhombic, quadrate at the angles.* — BRACHYTHECIUM. (*Brachythecium*, Schimp.)

++ *Pedicel smooth: monœcious, except* n. 10.

10. **H. lætum**, Bridel. Stems slender, 3 or 4 inches long, bright green, with erect rather rigid branches: leaves ovate-lanceolate, shortly acuminate, more or less striate, very minutely serrate above, areolation very long and very narrow: capsule erect-cernuous, narrowly oblong-cylindric, subarcuate: operculum narrow-conic; annulus none: processes little shorter than the teeth, somewhat exceeding the 2 cilioke. — Sulliv. Icon. Muse. 185, t. 115. *Brachythecium lætum*, Bruch & Schimp. l. c., t. 554.

Yosemite Valley, sterile (*Bolander*); Wahsatch Mountains (*Watson*); common eastward, and also European.

11. **H. collinum**, Schleich. Stem densely radiculose, irregularly pinnate-branched with short branchlets: leaves densely imbricated, ovate-lanceolate, short-

acuminate, serrulate, areolation hyaline except at the angles; perichætial leaves abruptly narrow-acuminate: capsule cernuous, short-ovate, gibbous; operculum obtusely acuminate. — *Brachythecium collinum*, Bruch & Schimp. l. c., t. 548.

Yosemite Valley, sterile (*Bolander*); East Humboldt Mountains, Nevada (*Watson*); Cascade Mountains (*Lyall*); Rocky Mountains from British America to Colorado and Utah; Europe.

12. **H. Hillebrandi,** Lesq. Small and slender, yellowish; stem erect from an irregularly subpinnately or fasciculately branched base: leaves ovate-lanceolate, long-acuminate, serrulate, the flat margin subreflexed: capsule suberect on a pedicel a half-inch long or more, ovate upon a broad abrupt collum, constricted below the broad oblique mouth when dry: peristome pale yellow below, whitish above, the teeth, processes and ciliolæ equal. — Mem. Calif. Acad. i. 33. *Brachythecium Hillebrandi*, Lesq.; Sulliv. Icon. Musc. Suppl. 98, t. 74.

On rocks, Merced River, *Bolander*.

H. SALEBROSUM, Hoffm., has been collected in Washington Territory and Northern Idaho (*Lyall*), Northeastern Nevada, and Colorado; also in the Atlantic States and Europe. It resembles *H. latum*, but is stouter, monœcious, and with a turgid gibbous-ovate cernuous capsule. — Wilson, Bryol. Brit. t. 55; Sulliv. in Gray's Man. 2 ed. t. 5. *Brachythecium salebrosum*, Bruch & Schimp. l. c., t. 549.

++ ++ *Pedicel roughened.*

= *Monœcious.*

13. **H. rutabulum,** Linn. Rather stout, loosely cespitose, deep or yellowish green; stems 3 to 5 inches long, with ascending or erect sparingly divided branches: leaves spreading, broadly ovate-lanceolate, acuminate, serrulate, scarcely sulcate, loosely rhombic-areolate: capsule cernuous or horizontal on a very rough purple pedicel, oval or oblong, subarcuate, with double annulus and large acute-conic operculum: peristome orange-red, pale above, the solitary ciliolæ equalling the processes and teeth. — Hedw. Musc. Frond. iv, t. 12. *Brachythecium rutabulum*, Bruch & Schimp. l. c., t. 543.

West Humboldt Mountains, Nevada (*Watson*); common in the Atlantic States and Europe.

14. **H. populeum,** Hedw. Yellowish-green and silky; stems 2 or 3 inches long, with ascending or arcuate branches: leaves ovate- or oblong-lanceolate, long-acuminate, serrulate above, margin flat, costa reaching to the apex: capsule cernuous upon a purple pedicel slightly scabrous above, oval or elliptic, with acute-conic operculum and narrow annulus; peristome yellow, the appendiculate ciliolæ frequently imperfect. — Hedw. Spec. t. 70; Fl. Dan. t. 2564. *Brachythecium populeum*, Bruch & Schimp. l. c., t. 535.

In the Sierra Nevada (*Hillebrand*); Atlantic States and Europe.

H. DECLIVUM, Mitten, Journ. Linn. Soc. viii. 33, t. 6, found in Northern Idaho (*Lyall*), has lanceolate long-acuminate falcate-secund serrulate leaves, an oval capsule horizontal and at length pendulous on the rather stout and very scabrous pedicel, the 2 appendiculate ciliolæ equalling the processes and teeth.

= = *Dioecious.*

15. **H. asperrimum,** Mitten. Resembling *H. latum*, but with a more rigid stem, the narrower leaves less plicate, and with fewer quadrate cells at the broadly decurrent angles, the pedicel scabrous and the conic operculum long-apiculate; ciliolæ slightly appendiculate, equalling the processes and teeth. — Journ. Linn. Soc. viii. 33, t. 6. *H. vallium*, Sulliv. & Lesq. Musc. Am.-Bor Exsicc. 2 ed. n. 506. *Brachythecium asperrimum*, Sulliv. Icon. Musc. Suppl. 100, t. 76.

On rocks in cañons (*Bolander*); British Columbia, *Douglas, Lyall.*

16. **H. Bolanderi,** Lesq. Broadly cespitose, pale green; branches elongated and flexuous, or suberect and rigid, irregularly subpinnately branched: leaves spreading, ovate-lanceolate, shortly acuminate, margin flat and serrulate, areolation rather loose, narrow and pellucid, the alar ovate-quadrate; perichætial leaves abruptly

attenuate to a flexuose point: capsule gibbous-ovate on a red rugose pedicel ½ inch long, with broad compound annulus and short acute-conic operculum: cilioke 2, very slender. — Trans. Amer. Phil. Soc. xiii. 12; Sulliv. & Lesq. l. c., n. 502.

On the ground under *Umbellularia Californica*, Oakland, *Bolander*.

+ + + *Branching pinnate or somewhat irregular and fascicled: leaves not sulcate or scarcely so, nor decurrent; areolation linear-oblong, rounded at the angles: flowers dioecious: capsule sometimes nearly erect and subsymmetrical: pedicel smooth.*

17. **H. myosuroides**, Linn. Stems slender and branches incurved, often flagelliform: leaves ovate-lanceolate, very finely acuminate, serrulate above, costate beyond the middle; perichætial leaves with very slender abrupt recurved apex: capsule oblong on a smooth elongated pedicel: processes (at length bifid) nearly equalling the teeth, a half longer than the 2 cilioke. — Engl. Bot. t. 1567. *Isothecium myosuroides*, Brid.; Bruch & Schimp. Bryol. Eur. t. 534; Fl. Dan. t. 2750. *Eurhynchium myosuroides*, Schimp.

Near San Francisco, in dry woods (*Bigelow*); Port Discovery, Washington Territory (*Pickering*); Atlantic States and Europe, on the ground, rocks, and at the roots of trees. A very variable species, to which the following are probably to be referred, and holding an intermediate position between several of these nearly allied groups or so-called genera.

18. **H. stoloniferum**, Hook. Much larger, the leaves more elliptical, minutely papillose on the back above the middle and more coarsely serrate, and capsule more drooping; the cilioke equalling the processes. — Muse. Exot. t. 74; Mitten, Journ. Linn. Soc. viii. 34; Lesq. in Mem. Calif. Acad. 31; Sulliv. & Lesq. Muse. Am.-Bor. Exsicc. 2 ed. n. 425. *H. myosuroides*, var. *stoloniferum*, Muell. Syn. ii. 500.

Common on trees in the Coast Ranges (*Menzies, Bigelow, Bolander*), and northward to Alaska.

19. **H. Brewerianum**, Lesq. In dense tufts on dry rocks, of a darker color, with short stems and abruptly short-acuminate leaves strongly concave and scarcely denticulate. — Trans. Amer. Phil. Soc. xiii. 12, and Mem. Calif. Acad. i. 32; Sulliv. & Lesq. l. c., n. 426.

On metamorphic sandstone around San Francisco, *Brewer, Bolander*.

20. **H. aggregatum**, Mitt. Densely tufted, dull yellow, the elongated branches simple or sparingly divided: leaves broadly ovate, shortly acuminate: capsule cylindric, inclined, somewhat incurved; operculum acuminate: cilioke solitary, half as long as the processes. — Journ. Linn. Soc. viii. 35, t. 6; Lesq. in Mem. Calif. Acad. i. 32. *H. Brewerianum*, var., Sulliv. & Lesq. l. c., n. 427.

On trunks of trees in deep cañons, Oakland (*Bolander*); Vancouver Island, *Lyall, Douglas*. Mitten, l. c., describes several other species (*H. acuticuspis*, etc.) of Washington Territory and British Columbia, which much resemble these. *H. leucocladulum* and *H. compressulum*, Muell. (Flora, xxxiii. 79), from Oakland, Oregon (*Nevius*), belong evidently to the same alliance.

+ + + + *Branching irregular: leaves subdecurrent, not sulcate; areolation very narrow, flexuous, dilated at the angles: flowers dioecious: pedicel rough.* — SCLEROPODIUM. (*Scleropodium*, Schimp.)

21. **H. cæspitosum**, Wils. Densely cespitose, creeping, with short simple incurved branches: leaves spreading, subsecund, broadly ovate- to oblong-lanceolate, acutely acuminate, concave, serrulate, margins flat, costa reaching above the middle: capsule oblong, suberect upon a minutely tuberculate purple pedicel about ½ inch long, somewhat incurved; operculum conic-rostellate. — Engl. Bot. Suppl. t. 2878, and Bryol. Brit. t. 55; Sulliv. & Lesq. l. c., n. 510. *Scleropodium cæspitosum*, Bruch & Schimp. l. c., t. 556.

On shaded rocks and on the ground among redwoods, Oakland (*Bolander*); Europe.

22. **H. illecebrum**, Schwaegr. In less dense bright green patches, with incurved obtuse branches about an inch long: leaves closely imbricated, roundish

ovate, recurved-apiculate, very concave, minutely serrate above, margin flat, costa ceasing (excurrent) above the middle: capsule cernuous or horizontal on a very rough pedicel an inch long, ovate-oblong, abruptly incurved; operculum convex-conic, apiculate. — Engl. Bot. t. 2189; Wilson, Bryol. Brit. t. 35; Sulliv. & Lesq. l. c., n. 508, 509. *H. blandum*, Hook; Engl. Bot. Suppl. t. 2715. *Scleropodium illecebrum*, Schimp. Bryol. Eur. t. 557.

On ground and rocks, San Francisco, Oakland, and in the Sierra Nevada (*Bolander*); Europe. Several forms occur, sometimes in compact dark brown tufts, with densely imbricated ovate obtuse nearly entire leaves and julaceous branches (in water, Yosemite Valley), or subdendroidal, with acute nearly entire leaves.

23. **H. Californicum**, Lesq. Loosely cespitose, with rather long filiform rooting branches: leaves spreading and loosely imbricated, ovate-lanceolate, acuminate, concave, entire or nearly so, the stout nerve ceasing below the apex, alar areolation ovate-quadrate and more or less granulose; perichætial leaves broadly ovate-lanceolate with long filiform acumination: capsule ovate-cylindric, pale green, cernuous upon a long reddish pedicel papillose only above, somewhat constricted below the mouth, at length erect; operculum broad-conic, acutish: peristome red, the inner yellow, ciliolæ solitary or in pairs. — Trans. Amer. Phil. Soc. xiii. 13; Sulliv. & Lesq. l. c., n. 511.

On rocks and dry sand near the bay of San Francisco, *Bolander*.

* * *Operculum long-beaked.*

+– *Branching irregular: leaves spreading equally or subcomplanate: areolation narrowly rhombic-hexagonal and subflexuose, dilated at the angles: pedicels smooth.* — Rhynchostegium. (*Rhynchostegium*, Schimp.)

24. **H. rusciforme**, Weiss. Amphibious, rather rigid, deep or dusky green; branches subfascicled, rather long, often simple and naked below, arcuate: leaves firm, somewhat flattened, roundish ovate, shortly acuminate, serrate, costate nearly to the apex, areolation narrowly long-rhombic: capsule ovate, cernuous; annulus broad; operculum as long as the capsule: ciliolæ (2 or 3) nearly equalling the reddish teeth. — *H. ruscifolium*, Neck.; Engl. Bot. t. 1275; Fl. Dan. t. 2389. *H. riparioides*, Hedw. Musc. Frond. iv, t. 4. *Rhynchostegium rusciforme*, Bruch & Schimp. l. c., t. 515.

In a stream near Monte Diablo (*Hillebrand, Bolander*); Atlantic States and Europe. *H. Royæ*, Austin (Coult. Bot. Gaz. iii. 31), described from insufficient material, is referred by Mr. Austin to this group; collected in California by *Mrs. J. Roy*. It is said to be a small species, with straight stems, distant erectish leaves with oval- and oblong-rhombic areolation, etc.

+– +– *Branching more or less pinnate: areolation as in the last.* — Eurhynchium. (*Eurhynchium*, Schimp.)

++ *Pedicels smooth: leaves thin, subsulcate.*

25. **H. strigosum**, Hoffm. Stem creeping or decumbent, an inch long or more, the attenuated branches more or less erect, ½ inch long: leaves spreading, crowded, widely cordate-ovate, short-acuminate or obtusish, concave, costate above the middle, serrate to the base: male plants parasitic on the female: capsule cernuous or subhorizontal, ovate-oblong or incurved-cylindric: ciliolæ in pairs, slender. — Wilson, Bryol. Brit. t. 55. *H. pulchellum*, Hedw. Spec. Musc. t. 68. *Eurhynchium strigosum*, Bruch & Schimp. Bryol. Eur. t. 519.

On wet ground at Calaveras Grove (*Bolander*); Fort Colville and Galton Mountains (*Lyall*); Uinta Mountains (*Watson*); Atlantic States, Chili, and Europe.

++ ++ *Pedicels roughened.*

26. **H. Stokesii**, Turner. Branches ascending, simple below, densely pinnately or bipinnately branched above: cauline leaves remotish, squarrose, acuminate-cordate, on the branches smaller, erect-spreading, broadly ovate-lanceolate, serrate to the

base, costate to above the middle; perichætial leaves squarrose: capsule horizontal, oblong and subcylindrical, contracted below the throat when dry: teeth orange; processes yellow, dehiscent; ciliolæ 1 or 2, a half shorter. — Musc. Hib. t. 15, fig. 2; Fl. Dan. t. 2562, fig. 2; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 433. *Eurhynchium Stokesii*, Bruch & Schimp. l. c., t. 526.

On shaded ground and rocks, common (*Bigelow, Bolander*); Vancouver Island (*Lyall, Wood*); Europe.

27. **H. Oreganum,** Sulliv. Very near the last, but larger and more robust, the creeping stems 6 to 12 inches long or more, once or twice divided, regularly and closely pinnated: leaves thinner and firmer, the areolation longer and narrower; perichætial leaves reflexed. — Mem. Amer. Acad. n. ser. iv. 172, and Musc. Wilkes Exp. 16, t. 13, B; Sulliv. & Lesq. l. c., n. 434.

On decaying logs or on the ground in forests (*Bigelow, Brewer, Bolander*); Puget Sound (*Pickering*); Vancouver Island, *Wood.*

28. **H. colpophyllum,** Sulliv. Of similar habit, rather small: leaves scarious, very concave, spreading, ovate, very shortly acuminate, margin flat, serrulate, costa slender, the dentate tip excurrent above the middle, areolation very narrowly hexagonal-rhombic; perichætial leaves oblong-lanceolate, long-acuminate, nerveless, spreading above: capsule oblong-cylindric, cernuous, slightly curved, twice longer than the straight stout-beaked operculum: ciliolæ 2, equalling the teeth. — *Eurhynchium colpophyllum*, Sulliv. Icon. Musc. Suppl. 95, t. 71.

California, *Bigelow.*

+– +– *Ramification fascicled and somewhat dendroid: leaves complanate: areolation quadrate-rhombic above, narrowly oblong below: pedicels smooth.* — Thamnium. (*Thamnium*, Schimp.)

29. **H. Bigelovii,** Sulliv. Secondary stems arcuate-ascending, subfasciculately branched, 1 to 1½ inches high, rather stiff, in close mats: leaves bright green, spreading in two ranks, long-oblong, shortly acuminate, coarsely serrate above, margin inflexed on one side, costa ceasing below the apex; perichætial leaves lanceolate, linear-acuminate and serrate, suberect: flowers dioecious: capsule oblong-oval, inclined, with distinct collum, a little exceeding the straightish operculum: ciliolæ in pairs, strongly appendiculate, nearly equalling the processes. — Pacif. R. Rep. iv. 189, t. 8; Sulliv. & Lesq. l. c., n. 423.

In valleys of the Coast Ranges north of the bay of San Francisco, on shaded rocks, *Bigelow, Brewer, Bolander.*

H. Alleghaniense, Muell. Larger, 2 or 3 inches high; leaves less distinctly complanate, ovate-oblong, more concave, obtusish, coarsely serrate, costa dentate on the back: flowers bisexual or monœcious: operculum more oblique. — Sulliv. Icon. Musc. 161, t. 103; Sulliv. & Lesq. l. c., n. 288. *Thamnium Alleghaniense*, Bruch & Schimp. *H. neckeroides*, Mitt. in Journ. Linn. Soc. viii. 38, not Hook. Vancouver Island (*Wood*) and Atlantic States.

§ 3. *Leaves smooth, mostly complanate or more or less secund, often shortly costate, bicostate, or nerveless: areolation mostly elongated rhombic: pedicels smooth: operculum convex-conic.*

* *Irregularly and sparingly branched, stoloniferous: leaves shining, thin, distichously complanate, ovate or ovate-lanceolate, nerveless or shortly bicostate, usually entire; areolation narrowly rhombic-hexagonal: mostly monœcious.* — Plagiothecium. (*Plagiothecium*, Schimp.)

+– *Peristome-teeth closely jointed; ciliolæ present.*

30. **H. denticulatum,** Linn. Stems prostrate, 2 or 3 inches long, with erect subfasciculate branches: leaves light green and glossy, obliquely ovate, short-acuminate, concave with margin recurved below, bicostate at base; areolation long-rhombic, quadrate at the angles: capsule arcuate-oblong or -cylindric, on a red curved pedicel

(an inch long from the base of the branches); operculum acute-conic: teeth reddish brown, the solitary ciliolæ as long. — Hedw. Musc. Frond. iv. 81, t. 31; Engl. Bot. t. 1260; Wilson, l. c., t. 24; Berkeley, l. c., t. 12, fig. 2. *Plagiothecium denticulatum*, Bruch & Schimp. l. c., t. 501.

In the Coast Ranges, Mendocino City, and on redwood trees in Jackson Valley (*Bolander*); Fort Colville (*Lyall*); in the White Mountains and Europe.

31. **H. undulatum**, Linn. Procumbent, sometimes 6 inches long or more, the usually simple branches 2 inches long or more: leaves whitish, crowded, ovate, acute, transversely undulate, entire, one or both margins incurved at base, shortly bicostate, areolation very narrow: flowers dioecious: capsule subcylindric upon a pedicel 2 inches long, curved, striate when dry, brownish yellow; operculum acute or rostellate: teeth yellowish; ciliolæ 3, slightly shorter. — Schwaegr. Suppl. t. 282; Wilson, l. c.; Berkeley, l. c., fig. 4. *Plagiothecium undulatum*, Bruch & Schimp. l. c., t. 506.

Swamps near the coast, Mendocino County (*Bolander*); Oregon (*Newberry*); Fort Nisqually (*Pickering*); Fort Colville (*Lyall*); Europe.

H. ROBUSTUM, Hook. Stem creeping, with very stout decumbent densely leafy broad flattened branches, 6 inches long or more: leaves yellowish, falcate-secund, lanceolate, narrowly acuminate, striate, transversely undulate, bicostate at base, serrulate at the apex: capsule ovate-oblong, arcuate-horizontal on a pedicel an inch long. — Musc. Exot. t. 108; Schwaegr. Suppl. t. 261. *Stereodon robustus*, Mitten, Journ. Linn. Soc. viii. 41. Oregon (*Hall, Mohr*); Rocky Mountains (*Drummond*); also by *Menzies*.

H. PULCHELLUM, Dicks. Small, branches erect, scarcely a half-inch long: leaves subfalcate-secund, broadly lanceolate, narrowly attenuate, entire, nerveless, areolation very narrow: capsule oblong, suberect; operculum convex-conic: teeth pale yellow; ciliolæ in pairs. — Engl. Bot. t. 2006; Wilson, l. c., t. 25; Berkeley, l. c. fig. 1. *Leskea pulchella*, Hedw. Spec. t. 55. *Plagiothecium pulchellum*, Bruch & Schimp. l. c., t. 497. Fort Colville (*Lyall*); Europe.

H. TURFACEUM, Lindb. A similar slender species, with depressed-complicate and somewhat folded rather long-acuminate leaves serrate to the middle and nerveless: capsule oblong-cylindric, symmetrical, cernuous, sulcate when dry; ciliolæ one or two, long. — Fl. Dan. Suppl. t. 117. Fort Colville (*Lyall*); Europe.

H. ELEGANS, Hook. Stems procumbent, 1½ inches long: leaves distichously imbricated, ovate-lanceolate, acuminate, nerveless or obscurely 2-nerved at base, serrulate at the apex, areolation very narrow: capsule pendulous upon a short arcuate pedicel, oblong-ovate, nearly symmetrical; operculum broad, abruptly rostellate: ciliolæ 3, equalling the processes. — Musc. Exot. t. 9; Schwaegr. Suppl. t. 282; Wilson, l. c., t. 59; Berkeley, l. c. fig. 2. Vancouver Island (*Menzies*); White Mountains; Great Britain.

H. SYLVATICUM, Linn. Resembling *H. denticulatum*, but stouter and with duller darker green foliage, the leaves less complanate, not acuminate: flowers dioecious: operculum long-conic. — Schwaegr. Suppl. t. 87; Wilson, Engl. Bot. Suppl. t. 2936, and l. c., t. 59. *Plagiothecium sylvaticum*, Bruch & Schimp. l. c., t. 503. Oregon (*Hall*); White Mountains; Europe.

+ + *Peristome-teeth remotely jointed; ciliolæ none.*

H. TRICHOPHORUM, Spruce. Resembling *H. denticulatum*, but more slender: leaves less complanate and less spreading, sulcate, pilose-apiculate: capsule narrower, suberect or erect when dry. — *Plagiothecium piliferum*, Bruch & Schimp. l. c., t. 496. Oregon (*Hall*); Rocky Mountains of British America (*Drummond*); Europe.

* * *Creeping, irregularly branched, never stoloniferous: leaves dull or shining, spreading or subsecund, ovate-lanceolate to lanceolate, costate to above the middle; areolation rather loose, not linear nor flexuose: monœcious.* — AMBLYSTEGIUM. (*Amblystegium*, Schimp.)

+ *Leaves dull: areolation wholly parenchymatous.*

32. **H. compactum**, Muell. Stems slender, mostly erect, an inch long or more, in broad very compact tufts, fasciculately branched: leaves erect-spreading, rarely subsecund, narrowly ovate-lanceolate and acuminate, slightly serrulate especially toward the base, the stout costa continuous nearly to the apex: areolation narrowly rhombic and subflexuose, subquadrate at the angles: capsule slightly inclined on an elongated pedicel, oblong with distinct collum, slightly incurved, contracted

below the broad mouth when dry; operculum conic-rostellate; annulus simple: processes shorter than the pale yellow teeth; ciliolæ solitary, very short. — Syn. ii. 408; Sulliv. Icon. Musc. 201, t. 123.

On streambanks, West Humboldt Mountains, Nevada (*Watson*); Fort Colville (*Lyall*); British America, *Drummond*. Common in various forms from California to Alaska and across the continent; also in Europe and South America.

33. **H. serpens**, Linn. Densely cespitose, with simple filiform flexuose-erect branches: leaves spreading, erect when dry, very small, ovate-lanceolate, narrowly acuminate, entire, costate to the middle or nearly to the apex: capsule incurved-cernuous, long-cylindrical, subarcuate, strongly arcuate when dry; operculum convex-conic, acute: ciliolæ in pairs, equalling the reddish teeth. — Hedw. Musc. Frond. iv. 45, t. 18; Engl. Bot. t. 1037. *H. contextum* and *H. spinulosum*, Hedw. Spec. t. 69, 72. *Amblystegium serpens*, Bruch & Schimp. l. c., t. 564.

Common in California (*Bigelow*), on the roots of bushes in swamps (*Bolander*), on the ground near Crescent City (*Brewer*); mountains of Nevada (*Watson*); and from Alaska to British America, Colorado and the Atlantic States; Europe and South America. A very variable species. *H. radicale*, Beauv. (Schwaegr. Suppl. t. 20. *Amblystegium radicale*, Bruch & Schimp. l. c., t. 565), is a more robust and rigid form, with leaves nearly twice larger and more abruptly acuminate from a broader base. *H. orthocladon*, Beauv. (Sulliv. Icon. Musc. t. 122), and *H. noterophilum*, Sulliv., which have been credited to the Pacific Coast, together with various other supposed species, are considered referable to this.

+ + *Leaves thin and shining: areolation narrowly rhombic, rather loose at base, rectangular at the angles.*

34. **H. riparium**, Linn. Creeping, in swampy places, or often in water with the stems and branches much elongated, distantly and subpinnately branched: leaves remote or somewhat crowded, usually distichously complanate, rarely subsecund, broadly ovate- or oblong-lanceolate, more or less long-acuminate, entire, costa ceasing above the middle: capsule oblong-cylindric, cernuous, incurved: ciliolæ 2 or 3, a third shorter than the processes. — Hedw. Musc. Frond. iv. 7, t. 3; Engl. Bot. t. 2060; Berkeley, Brit. Moss. t. 6, fig. 3. *Amblystegium riparium*, Bruch & Schimp. l. c., t. 570. *Amblystegium vacillans*, Sulliv. Icon. Suppl. 96, t. 72; fide Austin.

Frequent in California (*Bigelow, Brewer, Bolander*); Northeastern Nevada and Utah (*Watson*); common in the Atlantic States and ranging from Greenland to Cuba, and throughout Europe.

§ 4. *Leaves smooth and shining, squarrose or usually falcate-secund, nerveless or shortly 1 – 2-costate: areolation linear, usually flexuose or vermicular: pedicels smooth: operculum convex-conic or rostellate.* — Hypnum proper.

* *Stem rootless or nearly so (except in* n. 37*), ascending; branches subpinnate with arcuate branchlets: leaves firm, falcate-secund, filiformly attenuate, costate beyond the middle or nearly to the apex: mostly marsh species.* — Harpidium.

+ *Diœcious.*

35. **H. aduncum**, Hedw. Stem erect, 2 to 6 inches long, slender, sparingly branched, and subpinnate with short simple branchlets: leaves crowded, lanceolate, long-acuminate, striate, subserrulate below, the stout costa reaching nearly to the apex; areolation somewhat rectangular, broader and subquadrate in the angles: capsule cernuous, incurved-oblong, at length arcuate; annulus broad, compound; operculum convex-conic: ciliolæ 2 or 3, short. — Musc. Frond. iv. 62, t. 24; Fl. Dan. t. 2563, 2621; Bruch & Schimp. Bryol. Eur. t. 605, and Suppl. Hypn. t. 1; Berkeley, l. c., t. 10, fig. 2.

In swamps near San Francisco (*Bolander*); Virginia and Clover Mountains, Nevada (*Watson*); British America to the Atlantic States, in South America and through Europe. A very variable species.

36. **H. exannulatum**, Gumb. Distinguished from the last by its more shining and more hooked-secund leaves, costate to the apex and with very narrow closer

areolation, serrulate especially below and remotely denticulate above, the capsule without annulus. It differs from *H. fluitans* in its firmer narrower less crowded more falcate and more narrowly areolate leaves, more distinctly auricled at base, and the larger peristome with a broader basal membrane. — Bryol. Eur. t. 602.

Var. **cochleæ**, Austin. Stem strict, rigid: leaves erect, variegated with purple, usually entire above and spirally twisted when dry, distinctly serrate at the slightly narrowed base. — Coult. Bot. Gazette, ii. 143. *Dichelyma Swartzii*, Lesq. in Mem. Calif. Acad. i. 28; Sulliv. & Lesq. l. c. 2 ed. n. 344.

In upland swamps, Tulare County (*Brewer*); in pools on Mount Dana and swamps near Mendocino City, *Bolander*. A European species, forms of which are also found in the Atlantic States.

37. **H. commutatum**, Hedw. Stem procumbent or suberect, pinnately branched, 4 to 12 inches long or more, brownish tomentose; branches slender, ½ inch long: leaves falcate-secund, twisted when dry, ovate-lanceolate from a broad base, narrowly acuminate, sulcate, the upper auricle flat and erose-denticulate, the lower decurrent and entire, the stout costa reaching to the apex, areolation long-linear, subflexuous, hexagonal-quadrate at the angles: capsule oblong-cylindrical, cernuous and arcuate; annulus broad; operculum acute: ciliolæ 3, long. — Musc. Frond. iv. 68, t. 26; Bruch & Schimp. l. c., t. 607; Berkeley, l. c., t. 10, fig. 5.

On the east side of Mono Pass (*Bolander*); Europe.

H. FILICINUM, Linn. More slender than the last and less regularly pinnate, the much smaller firmer and more stoutly costate leaves not twisted when dry and the areolation much shorter: tomentum more dense: annulus simple. — Hedw. Spec. t. 76; Engl. Bot. t. 1570; Bruch & Schimp. l. c., t. 609. Washington Territory (*Lyall*); Rocky Mountains from British America to Utah and Colorado; Atlantic States and Europe.

+ + *Monœcious.*

38. **H. uncinatum**, Hedw. Stem erect or prostrate, remotely pinnate-branched, slender, about 2 inches long; branchlets falcate: leaves crowded, yellowish green and glossy, strongly falcate-secund, very long and narrow and subsetaceous from a broad base, distinctly plicate-striate, serrulate, costate to near the apex; areolation very narrow, looser at base and more broadly rectangular at the angles; perichætial leaves very long and hair-pointed, erect, striate: capsule oblong-cylindric, cernuous, incurved: ciliolæ 2, nearly equalling the processes. — Musc. Frond. iv. 65, t. 25; Bruch & Schimp. l. c., t. 600; Berkeley, l. c., t. 11, fig. 1.

Frequent in the Sierra Nevada, and throughout North America from arctic regions to Utah, Colorado and the Atlantic States; also Europe and Asia.

H. FLUITANS, Linn. Stems pinnate, erect or floating, in swamps or stagnant waters, ½ to 1 foot long or more; leaves loosely imbricated, flaccid and often not falcate-secund, long-lanceolate and acuminate, nearly entire, costate to above the middle: annulus none: ciliolæ often imperfect or united. — Hedw. Musc. Frond. iv. 94, t. 36; Eng. Bot. t. 1448; Bruch & Schimp. l. c., t. 602. Oregon (*Hall*); Uinta Mountains (*Watson*); from Arctic America to the Atlantic States, and in Europe and South America.

* * *Stem more or less regularly pinnate: leaves crowded and falcate-secund in one or two ranks, shortly bicostate or nerveless: areolation narrowly linear, quadrate at the angles.* — DREPANIUM.

39. **H. fertile**, Sendt. In soft depressed subcircular bright green and yellowish tufts, densely pinnately branched: leaves somewhat 2-ranked, narrowly lanceolate and attenuate to a hair-like apex, strongly incurved, subcircinate when dry, minutely serrulate at the apex, the lower margin reflexed, very obscurely bicostate at base: flowers monœcious: capsule oval or oblong, cernuous, subarcuate, brownish above, paler below, with broad annulus and large convex-apiculate operculum. — Bruch & Schimp. l. c., t. 591.

On rocks in the Calaveras Grove (*Bolander*); Europe.

40. **H. subimponens**, Lesq. Stems procumbent, sparingly branched, slender, the branches closely plumose-pinnate: leaves strongly falcate-secund, ovate- to oblong-

lanceolate, long-acuminate, subdenticulate at the apex, nerveless or obscurely bicostate at base; quadrate alar cells few or none: flowers dioecious: capsule long-cylindric, subcernuous, curved, with broad compound annulus and obtuse conic or subrostellate operculum: ciliolæ 2, a little shorter than the processes. — Trans. Amer. Phil. Soc. xiii. 14; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 476; Sulliv. Icon. Musc. Suppl. 103, t. 79. *H. plumifer*, Mitten, Journ. Linn. Soc. viii. 41, t. 7?

On shaded rocks in woods, at Oakland and in the Sierra Nevada (*Bolander*); Vancouver Island, *Lyall*. Mitten's species appear to differ only in the somewhat more narrowly and acutely beaked operculum.

41. **H. circinale**, Hook. Stems creeping, slender, 2 to 4 inches long, flexuous, simply pinnate, the numerous branches scarcely ½ inch long, or sometimes 2 inches long and flexuous: leaves secund, lanceolate with a long-subulate subserrate apex, strongly circinnate, nerveless; perichætial leaves erect; basal areolation vesicular, yellow: capsule small, ovate upon a broad arcuate collum, horizontal or subpendulous; operculum short-conic: ciliolæ 1 or 2, rather shorter than the processes. — Musc. Exot. t. 107; Sulliv. & Lesq. l. c., n. 474. *H. Sequoieti*, Muell. in Flora, 1875, 91.

In the Coast Ranges, on redwoods (*Bolander*); at the base of trees, Siskiyou Mountains (*Brewer*); Washington Territory (*Pickering*); Vancouver Island, *Lyall*, *Menzies*.

* * * *Stem prostrate and ascending, irregularly branched: leaves secund or spreading every way, broadly ovate to long-lanceolate, shortly or obsoletely* 1–2-*costate, areolation very narrowly linear.* — LIMNOBIUM.

42. **H. arcticum**, Sommerf. Branches elongated, crowded, simple, rigid, obtuse, 1 or 2 inches long or more: leaves reddish or yellowish brown, widely spreading, roundish, subacute or obtuse, entire, bicostate to the middle, areolation not dilated at the angles: flowers monœcious: capsule suberect or cernuous, oval upon a distinct narrow collum, arcuate when dry; annulus double; operculum short-conic, acute: ciliolæ short. — Wahl. Fl. Lapp. Suppl. t. 2; Bruch & Schimp. l. c., t. 578; Wilson, l. c., t. 56; Berkeley, Brit. Moss. t. 7, fig. 3.

On Mount Dana, in streams, submerged (*Bolander*); Oregon (*Hall*); Rocky Mountains of British America (*Drummond*); Europe.

H. EUGYRIUM, Schimp. Leaves broadly ovate- to oblong-lanceolate, shortly acuminate, subfalcate-secund, more or less complicate and contorted, shortly bicostate, the alar areolation large, pellucid and yellow: flowers monœcious: capsule ovate-oblong, cernuous-incurved; annulus very broad: ciliolæ nodose. — Sulliv. & Lesq. l. c., n. 303 (2 ed. n. 450). *Limnobium eugyrium*, Bruch & Schimp. l. c., t. 579. Oregon (*Hall*); in the Alleghanies and White Mountains; also in Europe.

H. OCHRACEUM, Turner. Stem and branches elongated: leaves falcate-secund, ovate- to elongated oblong-lanceolate, short- or long-acuminate, more or less contorted, striate, costa single or forked, reaching to the middle; perichætium squarrose: flowers dioecious: capsule ovate or oblong, arcuate upon an erect attenuate collum; annulus broad, triple: ciliolæ very slender. — Wilson, l. c., t. 58; Sulliv. & Lesq. l. c., n. 305. *Limnobium ochraceum*, Bruch & Schimp. l. c., t. 580. Oregon (*Hall*); White Mountains; Europe.

* * * * *Stems pinnately or bipinnately branched: leaves shining, ovate-cordate to oblong, spreading every way or rarely secund, shortly costate: dioecious.* — HYLOCOMIUM.

H. SPLENDENS, Hedw. Stems 2 to 6 inches long, interruptedly 2–3-pinnate, villous: stem-leaves broadly ovate-oblong, cirrhose-acuminate, concave, serrulate, margin below recurved, bicostate at base: capsule ovate, cernuous, curved; operculum with slender acute beak. — Spec. t. 67; Engl. Bot. t. 1424. *Hylocomium splendens*, Schimp. Bryol. Eur. t. 487. Oregon (*Pickering*, *Newberry*, *Hall*); Vancouver Island (*Lyall*, *Wood*); Atlantic States and Europe.

H. TRIQUETRUM, Linn. Stem erect, 6 inches high or more, rigid, subpinnate, with drooping branches an inch long: leaves squarrose, triangular-acuminate from a cordate clasping base, plicate-striate and bicostate to the middle, serrulate above: capsule roundish ovate, gibbous, cernuous; annulus simple; operculum conic-mamillate. — Engl. Bot. t. 1622. *Hylocomium triquetrum*, Schimp. l. c., t. 491.

Cascade Mountains, Oregon (*Newberry*); Columbia River (*Hall*); Europe.

H. LOREUM, Linn. Stem more or less erect, less rigid, ½ to 1 foot long, irregularly pinnate: leaves squarrose, recurved and subsecund, ovate-lanceolate, acuminate, plicate-striate below and usually 2-nerved at base, serrulate: capsule subglobose, abruptly horizontal, sulcate when dry; operculum short-conic, apiculate. — Engl. Bot. t. 2072; Berkeley, l. c., t. 9, fig. 4. *Hylocomium loreum*, Schimp. l. c., t. 490. Oregon (*Pickering, Hall, Nevius*); Vancouver Island (*Lyall, Wood*); Europe.

ORDER CXXVII. SPHAGNACEÆ.

Moss-like soft and flaccid plants, in bogs or swamps, fasciculately branched and with imbricate concave nerveless colorless and nearly transparent leaves, and bearing an operculate capsule containing both macrospores and microspores. Inflorescence dioecious, or monoecious with the male and female flowers on different branches. Male flowers never terminal, upon clavate catkin-like branches, the antheridia solitary at the side of each leaf, globose or ovoid, pedicellate, bursting elastically at the top and soon decaying. Archegonia with numerous filamentous arachnoid paraphyses, globose, 1 to 3 in a budlike terminal involucre, only one perfecting fruit, which after fertilization is raised out of the perichætium by a thread-like prolongation of the stem (*pseudopodium*) and remains sessile upon the dilated discoid summit of the pedicel, the envelope or calyptra bursting irregularly at maturity. Capsule spherical or ovoid, with convex operculum, the orifice without peristome or annulus; the short thick columella not extended beyond the base of the hemispherical sporangium. Spores of two kinds, the larger tetrahedral, the others polyhedral and many times smaller. Macrospore on germination producing a slender filamentous or at length expanded prothallus on which leaf-buds are formed.

An order intermediate in its characters between the true Mosses and the *Hepaticæ*, consisting of a single genus of long-lived perennials, of temperate and cold regions of both hemispheres. The stems consist of a cylinder of brown firm thick-walled cells, enclosing a bundle of thin cells, and surrounded by one or more layers of very broad empty perforated cells (*utricles*) with a network of intermediate narrow tubular cells (*ducts*) containing chlorophyll. A fascicle of short branches is produced by the side of the insertion of each fourth leaf, some reflexed, sterile and appressed to the stem, and others spreading, the uppermost fascicles crowded into a dense terminal mass. A solitary innovation arises from near the summit. Rhizoids none. Leaves 5-ranked, broad-ovate to linear-lanceolate, formed of heterogeneous tissue similar to that of the epidermis of the stem. The porous structure of the stem and leaves makes them exceedingly absorbent of moisture, and in their native bogs they are always soaked with water to their very summits like a sponge. As by their innovations they are continually growing at the top while decaying at the bottom, they at length form deep deposits of "peat" and supply an excellent fuel in regions where wood is wanting.

1. SPHAGNUM, Dillenius.

Characters as of the order.

About 50 species are known, 22 in North America. The genus is sparsely represented in California.

* *Leaves obtuse, roundish or elliptical.*

1. **S. cymbifolium,** Ehrh. Stems robust, 3 inches to a foot long or more; branches 3 to 6 in a fascicle, short, tumid, the cortical cells spiral-striate: cauline leaves mostly reflexed, spatulate, rounded at the apex; branch leaves imbricate, roundish ovate, cucullate and entire, very concave, papillose on the back near the apex: flowers dioecious: capsule globose on an elongated pedicel, stomatose. — Wilson, Bryol. Brit. t. 4; Schimp. Sphagn. 69, t. 20; Sulliv. in Gray's Man. 2 ed. t. 1; Berkeley, Brit. Moss t. 2, fig. 1. *S. latifolium*, Hedw.; Engl. Bot. t. 1405.

Swamps near Mendocino City (*Bolander*); Atlantic States, common; throughout Europe. Pale or frequently purplish.

2. **S. compactum**, Brid. Stems more or less densely cespitose, 2 to 5 inches high, dichotomously divided; branches 2 or 3 in a fascicle, much crowded, short, erect or spreading; cortical utricles without striæ: cauline leaves minute, ovate, reflexed; branch leaves erect-spreading, ovate-oblong, concave with inflexed margin, obtusely toothed and usually cucullate at the apex; ducts compressed and wholly included between the utricles: monœcious, the male flowers on the pendulous branches: capsule immersed or shortly emergent, truncate-oblong. — Schwaegr. Suppl. t. 3; Wilson, l. c., t. 61. *S. rigidum*, Schimp. l. c., t. 18.

Yosemite Valley in the spray of Vernal Falls, and on Mount Dana (*Bolander*); Alleghany Mountains; Europe.

3. **S. molluscum**, Bruch. Stems delicate, very fragile, 2 to 6 inches high, very softly cespitose, simple or biparted; branches 1 to 3, short, slender, all spreading or 1 or 2 reflexed: stem leaves erect-spreading or reflexed, roundish ovate with incurved margin; branch leaves loosely imbricated or occasionally secund, elliptical or ovate-oblong, very concave, incurved above; ducts compressed-triangular, the lower surface free: dicœcious, the male plants usually in distinct tufts: capsule small, reddish, more or less exserted. — Wilson, l. c., t. 60; Schimp. l. c., t. 21; Berkeley, l. c., fig. 3.

Cascade Mountains, Oregon (*Newberry*); New Jersey; Europe.

* * *Leaves acute or acuminate, ovate or ovate-lanceolate.*

\+ *Leaves erect-spreading.*

4. **S. acutifolium**, Ehrh. Stems slender, 5 to 10 inches long, loosely cespitose, usually more or less tinged with purple; branches in numerous fascicles of 3 to 5, slender, attenuate: cauline leaves acuminate-ovate, mostly erect, concave, erose at the apex; branch leaves imbricate, ovate- to long-lanceolate, very concave, erose at the slightly truncate apex; ducts triangular, the upper side free: flowers monœcious: capsule long-pedicelled. — Schwaegr. Suppl. t. 5; Wilson, l. c., t. 4; Schimp. l. c., t. 13, 14; Berkeley, l. c., fig. 4. *S. capillifolium*, Hedw.; Engl. Bot. t. 1406.

Upper Tuolumne Cañon and on Mount Dana (*Bolander*); on the Columbia River (*Newberry*); frequent in the Atlantic States and Europe.

5. **S. fimbriatum**, Wilson. Much like the last, but more slender and delicate, green, never purplish, often a foot long or more; branches very attenuate, arcuately decurved: cauline leaves closely appressed, obovate-spatulate, very obtuse, laciniately fringed; branch leaves acuminate, entire at the apex; perichætial leaves large, obovate, repand, and convolute: pedicel shorter. — Bryol. Brit. t. 60; Schimp. l. c., t. 15.

On Mount Brewer, at 11,000 feet altitude (*Bolander*); British America (*Drummond*); northern Atlantic States and Europe.

6. **S. Mendocinum**, Sulliv. & Lesq. Stems 7 to 10 inches long, in loose floating mats, reddish yellow above, pale yellowish below; branches in fascicles of 3 to 5, long, flexuose and attenuate, spreading: cauline leaves oblong-ovate, obtusish, suberect or recurved-spreading; branch leaves loosely imbricate, oblong-lanceolate, acuminate, concave, convolute and toothed at the apex; ducts narrowly triangular, the outer side free: fruit unknown. — Sulliv. Icon. Musc. Suppl. 12, t. 3. *S. auriculatum*, Lesq. Mem. Calif. Acad. i. 4, not Schimp.; Sulliv. & Lesq. Musc. Am.-Bor. Exsicc. 2 ed. n. 23.

In great bogs near King's River, at 8–9,000 feet altitude (*Brewer*); swamps near Mendocino City, *Bolander*.

\+ \+ *Leaves more or less squarrose or subsecund.*

7. **S. subsecundum**, Nees and Hornsch. Stems 3 to 6 inches long or more, in yellowish green or often brownish variegated mats; cortex simple; branches 2 or 3 together, attenuate or flagelliform, recurved: cauline leaves small, broadly

ovate, cucullate and obtusish at the apex; branch leaves loosely imbricated or usually secund and subfalcate, broadly acuminate-elliptic, very concave with incurved margins, 2 – 3-toothed at the apex; ducts much compressed: flowers diœcious: capsule long-pedicelled. — Bryol. Germ. i. 17, t. 3; Schimp. l. c., t. 22, 23; Fl. Dan. t. 2754. *S. contortum*, Schultz; Wilson, l. c., t. 60.

Var. **longifolium**, Lesq. Leaves narrowly lanceolate, elongated. — Mem. Calif. Acad. i. 4.

In wet meadows, Mariposa Grove, and the variety in swamps near Mendocino City (*Bolander*); Atlantic States and Europe.

8. **S. squarrulosum**, Lesq. Imperfectly described: slender, densely cespitose, deep green above, whitish beneath; cortex double; branches long, slender: branch leaves lanceolate, squarrose above the middle: fruit unknown. — Mem. Calif. Acad. i. 3. *S. squarrosum*, var. *squarrulosum*, Schimp. Syn. 2 ed. 836.

Head of William's Lake, near Lassen Peak, at 5,000 feet altitude (*Brewer*); also detected by Lesquereux in Switzerland.

ADDITIONS AND CORRECTIONS

TO VOL. I.

Page xii. Insert at bottom.

Herbs or shrubs with alternate simple leaves, monœcious flowers, and 3-lobed 3-seeded capsule. Argythamnia in EUPHORBIACEÆ, 87.

Page xvii. Insert at end of group * * * * .

Fruit a 3-lobed and 3-celled 3-seeded capsule. Flowers monœcious, mostly 5-merous. Filaments united. Styles 1–3-dichotomous. Herbs or shrubs with alternate simple leaves and purplish juice. ARGYTHAMNIA in *Euphorbiaceæ* (vol. ii. 69).

Page 2. Insert in *Synopsis of Genera*.

4ª. **Trautvetteria**. Flowers perfect, corymbose, white. Sepals not spurred. Petals none. Akenes numerous, capitate, 4-angled.

6ª. **Coptis**. Petals linear-filiform, cucullate in the middle. Leaves ternate, radical from a running rootstock. Stem scape-like. Carpels 3 to 7, stipitate.

Page 4. **2. ANEMONE.**

2ª. **A. Drummondii**. Resembling *A. multifida*, but rather more slender, and the villous pubescence more scanty and less spreading: leaves mostly smaller, with shorter and narrower segments: heads ovate: style more slender and elongated (1½ lines long): akenes larger and oblong (2 lines long), and less densely woolly. — *A. Baldensis*, Hook. Fl. Bor.-Am. i. 15.

Sierra County (*Lemmon*); Lassen's Peak, at 9–11,000 feet altitude (*Mrs. Austin*); Scott Mountains, near snow (*Greene, Lemmon*); and in the Rocky Mountains, lat. 49° (*Lyall*) and lat. 52–55°, *Drummond*. *A. multifida* does not appear to have been yet found in California, though collected on the Columbia River by *Douglas* and in the Clover Mountains, Nevada, by *Watson*.

3. **A. nemorosa**, Linn. A form of this species with large bright blue flowers occurs in Oregon, on Hood River (*Mrs. P. G. Barrett, J. Howell*), and in Klickitat County, Washington Territory, *W. N. Suksdorf*.

4. **A. deltoidea**, Hook. Head of Scott River, near Jackson Lake, Siskiyou County, *Rev. E. L. Greene*.

3. THALICTRUM.

The Californian species are the following.

* *Flowers diœcious: anthers linear, acute or acuminate.*

1. **T. polycarpum**, Watson. Rather stout, 2 or 3 feet high or more, glabrous: leaves with short petioles or the upper sessile; leaflets variable, 3 to 12 lines long; lobes acutish to acuminate: panicle narrow, often small, the staminate usually crowded on short pedicels: anthers acute, on very slender filaments: fruit in dense heads, compressed, broadly oblong-obovate or obovate, abruptly acute, 2½ or 3 lines long: seed linear, terete, nearly 2 lines long. — Proc. Amer. Acad. xiv. 288. *T. Fendleri*, var. (?) *polycarpum*, Torr. in Pacif. R. Rep. iv. 61, in part.

Common in the Coast Ranges from Monterey to the Columbia River, and in the Sierra Nevada from the Yosemite Valley and Mono Pass northward.

2. **T. occidentale,** Gray. Of similar habit, the leaflets generally somewhat larger, rarely with a slight minute puberulence beneath: panicles more slender and open, the staminate very diffuse with slender elongated pedicels: styles more attenuate: fruit few (1 to 6) in each head, narrowly oblong (3 or 4 lines long) and narrowed at each end: seed nearly 3 lines long. — Proc. Amer. Acad. viii. 372; Watson, l. c.

In woods near Mount Grayback, San Bernardino County (*Lemmon*); Plumas County (*Mrs. R. M. Austin*); and common in Oregon and Washington Territory.

T. FENDLERI, Gray, of the Rocky Mountains and Utah, also found in the East Humboldt Mountains, Nevada (*Watson*), has not yet appeared from California. Rather low and slender, occasionally somewhat pubescent, with usually small leaflets and an open panicle: anthers setosely acuminate: fruit slightly glandular-puberulent, oblong to ovate, acuminate, 2 or 3 lines long: seed broader and somewhat flattened, 1½ lines long.

* * *Flowers usually perfect: anthers small, elliptic-oblong, obtuse.*

3. **T. sparsiflorum,** Turcz. Slender, glabrous, 1 to 3 feet high: leaves sessile or nearly so; leaflets varying much in size (3 to 15 lines long), with obtuse often mucronate lobes: panicle loosely few-flowered; pedicels elongated: fruiting heads nodding, the large divaricate akenes strongly compressed, semi-obovate, shortly pedicellate, slightly nerved. — Regel, Thalict. 3, t. 1.

Parry's Cañon, west side of Mount Grayback, San Bernardino County (*Lemmon*); Warner Valley and Big Spring, Plumas County (*Mrs. R. M. Austin*); in the mountains of Colorado and Utah, and northward to Alaska. Also in Siberia.

Page 5. **4ª. TRAUTVETTERIA,** Fisch. & Mey. FALSE BUGBANE.

Sepals usually 4 (3 to 5), concave, petal-like, soon deciduous. Petals none. Pistils numerous. Akenes capitate, membranaceous-inflated, 4-angled. Seed ascending. — A perennial herb, with alternate palmately-lobed leaves, and small corymbosely panicled white flowers.

Three closely allied species, or forms, belonging to the Atlantic and Pacific Coasts and Japan respectively.

1. **T. grandis,** Nutt. Stem slender, 1 to 3 feet high: leaves few, the radical long-petiolate, the cauline on short petioles, thin, deeply 5 – 7-lobed, the lobes acuminate and irregularly laciniate-toothed; under side of the leaves and the panicle sparingly pubescent with spreading curled hairs: akenes little more than a line long, in globose heads, broadly gibbous at base, rather abruptly beaked by the slender revolute style. — Torr. & Gray, Fl. i. 37. *T. palmata,* var. *occidentalis,* Gray, Proc. Amer. Acad. viii. 372.

On Mill Creek, Plumas County (*Mrs. R. M. Austin*); Oregon. *T. palmata,* of the Atlantic States, has more coriaceous strongly veined leaves, the cauline sessile, and the larger akenes (2 lines long or more) oblong-obovate, acute at base, and abruptly beaked by the short style. The Japanese form has a narrowly ovate akene more attenuate upward into the straitish style.

5. RANUNCULUS.

1. **R. hederaceus,** Linn. The forms referred to this species should doubtless be considered as heterophyllous states of *R. aquatilis.* The plant collected by *Bigelow* (var. *Lobbii*) has 3-lobed floating leaves, at least the lateral lobes usually notched. A more common form (var. *heterophyllus*) has the leaves reniform-orbicular and subpeltate, about 5-lobed and the lobes 2 – 3-toothed. Both have shorter peduncles than is usual in Old World forms, resembling in this respect var. *brachypus,* Hook. & Arn., which has the leaves all submersed and dissected, as in var. *trichophyllus.*

2. **R. aquatilis,** Linn., var. **cæspitosus,** should be credited to De Candolle.

3. **R. hystriculus** Gray, is found near the Yosemite Falls, *Brewer, Mrs. S. P. Monks.*

6. **R. alismæfolius,** Geyer. The range of this species is from the Rocky Mountains westward. The allied eastern species is distinguished as *R. ambigens,* Watson.

10. **R. glaberrimus,** Hook. Extends to Washington Territory and Wyoming.

Group * * * includes the following species.

+ Leaves ternately or pinnately divided.

11ª. **R. multifidus,** Pursh. Stems floating or immersed, with ternately decompound leaves, the divisions long and filiform, or rooting in the mud and the leaves round-reniform and more or less deeply lobed and toothed; the terrestrial form often somewhat villous: petioles short, broadly stipulate-dilated at base: flowers large, bright yellow, the 5 to 8 petals with conspicuous obovate scales: akenes in a rather small globose head, beaked by a short straight style. — *R. Purshii,* Richards.; Hook. Fl. Bor.-Am. i. 15, t. 7.

Indian Valley, Plumas County (*Mrs. R. M. Austin*), and at Camp Bidwell, Modoc County, *Dr. Matthews.* Arctic America to Utah, Colorado and the Northern States, and in Siberia.

11ᵇ. **R. orthorhynchus,** Hook. More or less villous, the stems often slender, 1 or 2 feet high, from a thick-fibrous root: leaves pinnately divided, the divisions variously lobed and cut, the segments often narrow: sepals reflexed; petals 3 to 8 lines long, bright yellow or purple-tinged outside: akenes large, flattened, in a close globose head, with a slender straight beak as long as the body. — Fl. Bor.-Am. i. 21, t. 9.

Plumas County (*Mrs. Austin*); Siskiyou County (*Greene*), and northward to British Columbia.

12. **R. Californicus,** Benth., and var. **canus,** Brewer. From San Diego to Marin County.

13. **R. repens,** Linn., and 14. **R. macranthus,** Scheele.

+ + Leaves (at least the lower) only lobed.

15. **R. Nelsoni,** Gray, and var. **tenellus,** Gray. Leaves more or less deeply 3- (or rarely 5-) lobed, the uppermost rarely parted, the lower usually cordate in outline. — *R. Eisenii,* Kellogg, Proc. Calif. Acad. vii. 115, the leaves cuneate at base.

From San Diego to Alaska, the more slender form chiefly in California.

15ª. **R. Bloomeri.** Stout, glabrous or somewhat villous: leaves on long petioles broadly stipulate-dilated below, mostly broadly ovate with cordate or truncate base, slightly 3–5-lobed or the upper somewhat deeply so, crenate-toothed: flowers large; sepals reflexed; petals 6 or 7 lines long, with a broad transverse scale at base: ovaries in a depressed globose head, beaked by a stout straight style.

In wet grounds near San Francisco, *Dr. J. G. Bloomer.* The specimens are imperfect and not yet in fruit, but indicate a very distinct species.

15ᵇ. **R. sceleratus,** Linn. Glabrous: stems often stout and hollow, from a fibrous root, ½ to 2 feet high: lower leaves round-reniform, deeply 3–5-lobed, the lobes obtusely toothed above; upper leaves nearly sessile, more deeply and narrowly cut: petals scarcely exceeding the spreading sepals: akenes numerous, very small, in an oblong-ovate or cylindrical head, mucronate.

In Surprise Valley, Modoc County, *Dr. Matthews.* Probably introduced.

16. **R. hebecarpus,** Hook. & Arn. Guadalupe Island, *Palmer.* The variety *pusillus* should be credited to Prof. W. H. Brewer.

Page 9. **6. CALTHA.**

1. **C. leptosepala,** DC. Leaves round- to oblong-ovate (longer than broad), with a somewhat narrowed and quadrate base, usually very obscurely crenate above and rather coarsely and often acutely serrate below: flowers 1, very rarely 2, white

or often tinged with blue, the second flower subtended by a petioled leaf. — Hook. Fl. Bor.-Am. i. 22, t. 10.

At Sitka, and southward in the Rocky Mountains to New Mexico and Utah. Not yet found in California.

2. **C. biflora,** DC. Leaves round-reniform (broader than long), with broad often overlapping basal lobes, crenate or obscurely so: flowers rarely 2, the lower subtended by a sessile leaf or bract, greenish white or yellowish.

In the Sierra Nevada, subalpine, and northward to British Columbia. The Californian specimens seem to differ from the more northern ones only in their less distinct crenation, the veinlets often glandular-excurrent.

6ª. COPTIS, Salisb. Goldthread.

Sepals 5 to 7, petal-like, deciduous. Petals narrowly linear, mostly cucullate. Stamens 10 to 25. Carpels 3 to 8, in fruit folliculate and stipitate, 4 – 8-seeded. Seeds crustaceous, shining. — Low smooth evergreen perennials, with slender running rootstocks, subcoriaceous ternate radical leaves, and scape-like stems bearing 1 to 3 whitish flowers.

Four species are found in eastern Asia, one of which ranges also from Arctic America to the northern Atlantic States. The following are peculiar to the Pacific Coast.

1. **C. asplenifolia,** Salisb. Leaves ternate, biternate or ternate-quinate, the ovate divisions deeply 3 – 5-lobed and acuminately toothed: scape equalling or exceeding the leaves, 3 to 12 inches high: sepals very narrowly linear-lanceolate, 4 or 5 lines long, spreading or reflexed; petals a third shorter, nearly filiform, dilated and cucullate in the middle: fruit 4 to 6 lines long, exceeding the stipe. — Hook. Fl. Bor.-Am. i. 23, t. 11.

Mendocino County (*G. R. Vasey*); Cascade Mountains, Linn County, Oregon (*W. C. Cusick*); Columbia River (*Hall*); Sitka. The Alaskan specimens have the leaves generally more divided than those of Oregon and California.

C. occidentalis, Torr. & Gray (*Chrysocoptis occidentalis*, Nutt. in Journ. Philad. Acad. vii. 9, t. 1), is still imperfectly known but is supposed to be distinguished by its linear petals, similar to the sepals and not cucullate. The leaves are ternate, as in the simpler forms of the last. The seeds (a little more than a line long) are perhaps larger. The roots are said to be bright yellow. It has been collected in the Umpqua Mountains, Oregon (*Pickering*), and north to Northern Idaho, *Lyall*.

7. ISOPYRUM.

2. **I. stipitatum,** Gray. Roots fleshy-fibrous and fascicled (as in other species): radical leaves twice ternate, the leaflets on slender petioles, mostly 3-lobed or -parted; segments oblong, acutish: stems 3 or 4 inches high, equalling the leaves, 1 – 2-leaved at the summit and bearing a single flower: peduncle thickened at summit: sepals 4 or 5, oblong, 3 lines long: follicles shortly stipitate, broad-oblong, very obtuse, 3 lines long and 3 – 4-seeded. — Proc. Am. Acad. xii. 54. *I. Clarkii,* Kellogg, Proc. Calif. Acad. vii. 131.

Near Yreka, Siskiyou County, very common on hillsides under bushes (*Rev. E. L. Greene*); Mendocino County, *J. H. Clarke.* Flowering in April.

I. Hallii, Gray, Proc. Am. Acad. viii. 374, of the Columbia Valley, is 1 or 2 feet high, with large biternate leaves, the peduncle bearing a subumbellate corymb of 7 to 9 large flowers: follicles 2 lines long, ovate-oblong, acuminate.

Page 11.

9. DELPHINIUM.

6. **D. glaucum.** (Substitute for **D. scopulorum,** Gray.) Tall and stout, glabrous and more or less glaucous: leaves large, laciniately lobed and toothed, the segments mostly acuminate, the uppermost leaves sparingly lobed or entire and narrowly lanceolate: flowers pale blue, numerous in a narrow raceme, upon slender and

rather short pedicels, the somewhat minutely tomentose sepals rather narrow, about 6 lines long or less: ovaries glabrous.

In the Sierra Nevada, as stated, and the only species of the group that has been found there; flowering July and August.

7. **D. trolliifolium,** Gray. This species is glabrous, or the inflorescence somewhat pubescent with white usually spreading hairs, the large bright blue or reddish purple flowers comparatively few, upon long spreading pedicels: fruit 8 to 12 lines long: seeds dark, firm, obpyramidal, with a lighter truncate depressed summit.

Common on ridges throughout Humboldt County, where the stockmen call it "cow poison" (*Rattan*), and ranging northward to the Columbia River (*Hall, Howell*), on low dry grounds. Flowering from March to June.

D. OCCIDENTALE (*D. elatum*, var. (?) *occidentale*, Watson, Bot. King Exp. 11). This alpine or subalpine species ranges from Union County, Oregon (*W. C. Cusick*), to Colorado. It is readily recognized by the stiff glandular spreading pubescence, which extends rarely to the ovaries and fruit: flowers numerous, dull or dark blue, very variable in size, the raceme often compound: seeds light colored and somewhat spongy. Flowering from July to September.

D. SCOPULORUM, Gray, of the Rocky Mountains from British America to New Mexico, has not been found west of the East Humboldt Mountains, Nevada, *Watson*. It has generally more narrowly dissected leaves than the allied species, and the pubescence is a fine hoary tomentum. The fruit is also pubescent, about half an inch long, on stout suberect pedicels.

8. **D. nudicaule,** Torr. & Gray. Follicles narrowly oblong, 6 to 12 lines long, somewhat narrowed at base. The color of the flowers varies to yellow and greenish (*Mrs. R. M. Austin*).

9. **D. cardinale,** Hook. Follicles shorter and broader, obtuse at base. Flowers also occasionally yellow, *Mrs. A. E. Bush*.

Page 12. **10. ACONITUM.**

1. **A. Columbianum,** Nutt. (Substitute for **A. Fischeri.**) More or less pubescent above with short spreading yellowish viscid hairs: galea varying much in breadth and in the length of the beak. — Torr. & Gray, Flora, i. 34.

In the Sierra Nevada, from Walker River to Washington Territory, and eastward to Wyoming and Colorado. The Siberian *A. Fischeri* differs especially in its more cylindrical almost beakless galea, and in the pubescence, minutely puberulent or sometimes wanting.

Page 13. **13. CROSSOSOMA.**

2. **C. Bigelovii,** Watson. In Whitewater Cañon, San Bernardino Mountains (*S. B. Parish*), growing 5 feet high, among rocks; flowering in January or later.

Page 17. **2. NUPHAR.**

1. **N. polysepalum,** Engelm. Collected at Santa Cruz by *Hartweg*, found near San Francisco, and common about Humboldt Bay; Plumas County, *Mrs. Austin*.

A "white water-lily," doubtless a *Nymphæa*, is reported as growing in the mountain lakes at the head of Eel River. The genus is not otherwise known as occurring on the Pacific Coast. It is distingnished from *Nuphar* by its 4 oblong-lanceolate sepals, numerous large subpersistent petals imbricately inserted all over the ovary in many rows, stamens upon the ovary, the outer with dilated filaments, stigma concave and umbonate, fruit depressed-globose and ripening under water, and the seeds within a sac-like aril.

Insert in ordinal character of *Sarraceniaceæ*: —

Ovules anatropous, very numerous, on large placentæ projecting from the axis.

Page 20. **3. ROMNEYA.**

1. **R. Coulteri,** Harv. From San Diego to Santa Barbara County; branching from a shrubby base and growing 4 to 8 feet high; flowering from May to August.

Page 21.

4. ARCTOMECON.

Persistent petals at length somewhat scarious. Filaments exceeding the anthers. Ovary 3–6-carpelled, the short style bearing as many cordately 2-lobed capitately crowded stigmas. Capsule dehiscent to the middle. Seeds oblong, with the rhaphe carunculate-crested. — Gray, Proc. Amer. Acad. xii. 52, t. 2.

4ª. CANBYA, Parry.

Sepals 3, caducous. Petals 6, persistent, at length scarious and enwrapping the capsule. Stamens 6 to 9; filaments shorter than the oblong-linear anthers. Ovary subglobose, 3-carpelled, with nerve-like many-ovuled placentas: stigmas sessile, linear-oblong, appressed to the ovary over the placentas. Capsule ovoid, membranaceous, 3-valved, the valves separating to the base from the persistent filiform placentas. Seeds several, very smooth and shining, narrowly oblong-obovate and slightly curved; rhaphe naked. Embryo very small, cylindrical. — A dwarf glabrous annual, with alternate linear entire leaves and numerous filiform 1-flowered scapes. — Gray, Proc. Amer. Acad. xii. 51, t. 1.

1. **C. candida**, Parry. Scarcely an inch high, densely much branched, the small somewhat fleshy leaves and very short branches closely crowded: flowers white, the petals hardly 2 lines long. — Gray, l. c.

San Bernardino County, in sandy soil at head of the Mohave River, *Dr. E. Palmer*, May, 1876. Nearly allied to *Arctomecon*, and with that genus peculiar in its persistent scarious petals. The stigmas are essentially similar in both, in this genus divaricately divided to the base, the adjacent lobes coherent and applied over the placentas.

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7. DENDROMECON.

1. **D. rigidum**, Benth. Butte County, *Mrs. J. Bidwell*.

Page 24.

1. DICENTRA.

1. **D. formosa**, DC. In Del Norte County (*Rattan*), with yellowish white flowers. The seeds in this species are either smooth and shining or tuberculate and dull. Inner petals with a conspicuous usually purple or purplish crest.

2. **D. uniflora**, Kell. Flowers half an inch long, the divergent or reflexed tips of the outer petals equalling or exceeding the erect gibbous-saccate bases; inner petals not crested, the blade broadly hastate: capsule not exserted, abruptly beaked with the short style.

2ª. **D. pauciflora**. Scapes and leaves very slender, 4 to 8 inches high, from a running tuberiferous rootstock: leaves biternate with narrow segments: flowers 1 to 3, white or more or less tinged with rose-color, 8 to 12 lines long, the short stout straight spurs not divergent; spreading or reflexed tips of the outer petals 3 or 4 lines long; inner petals obscurely crested, the blade not broader at base: capsule exserted, attenuate into the elongated style.

Scott Mountains, near snow (*Rev. E. L. Greene*); near Castle Lake, *J. G. Lemmon*. Flowering in July and August.

2. CORYDALIS.

1. **C. Caseana**, Gray. Leaflets very variable in size, ¼ to 1 inch long, acute: hood of outer petals with straight slightly erose-undulate margin, obtusish and bearing a rather broad obtuse erose crest: capsule acute, ascending or reflexed.

2ª. **C. Bidwelliæ**. Similar in habit: leaflets small (2 to 4 lines long), acute or acuminate: hood narrower with somewhat more spreading and ragged margin,

narrowly acuminate with the narrow entire crest: spur more slender and somewhat curved.

Sierra Nevada, above Chico, *Mrs. J. Bidwell*.

C. Cusickii, collected in Union County, Oregon, by *W. C. Cusick*, is a similar species, with the broad margins of the hood produced beyond its acute apex and folded back over the narrow somewhat crisped or erose crest: leaves bipinnately divided, the oblong-oval leaflets acute at each end, half an inch long.

C. Brandegei, of the mountains of Southern Colorado and in the Wahsatch, and referred to *C. Cascana*, is tall and stout (5 feet high), with twice or thrice pinnately divided leaves, the lanceolate leaflets ½ to 1 inch long, acute or acuminate: hood not crested, the margins folded back and not projecting beyond the obtuse summit: capsule oblong-obovate, obtuse, reflexed.

Page 28. **3. DRABA.**

3. **D. aureola.** (Substitute for **D. aurea.**) Biennial or sometimes of longer duration, very densely pubescent with stellate hairs: stems stout, simple, 2 to 4 inches high: leaves crowded at base, the lowermost dead and blackened, spatulate, obtuse, entire, 3 to 6 lines long: raceme dense: flowers bright yellow: pods broadly oblong, obtusish at each end, pubescent, ascending, 2 to 4 lines long, mostly exceeding the pedicels, abruptly beaked by a rather short stout style.

Sierra Nevada, in Sierra County (*Lemmon*), and on Lassen's Peak, *Mrs. Austin*. The specimens from Mount Dana (*Brewer*) are probably the same, though more slender and with finer pubescence, and the flowers apparently white.

3ª. **D. corrugata.** Similar to the last, but the stellate pubescence coarser and more villous: stem branched from the base: flowers yellow, in shorter looser racemes, with narrower sepals and petals and more exserted stamens: pods oblong or oblong-lanceolate, 2 to 5 lines long, much exceeding the pedicels, pubescent, obtuse or more or less acute, beaked with a long very slender style, variously contorted.

San Bernardino Mountains; sides of Mount Grayback, *J. G. Lemmon*.

6ª. **D. Lemmoni.** Caudex stout and much branched: leaves crowded at the summit of the branches, broadly oblanceolate, obtusish or obtuse, 2 to 4 lines long, with long branching hairs on the margins and loosely scattered over the surface: scape (an inch high) and corymbed pedicels pubescent with horizontally spreading hairs: flowers yellow, nearly 2 lines long: pods ovate-lanceolate, beaked with a very short thick style, sparingly hairy, 3 lines long, rather exceeding the pedicels.

Summit of Mount Lyall, at 13,000 feet altitude, *J. G. Lemmon*, Aug. 1878.

Page 29. **4. DENTARIA.**

1. **D. tenella**, Pursh. Rootstock often tuber-bearing: pods 1 to 1¾ inches long, nearly a line broad, 4–8-seeded; style slender, 2 or 3 lines long; stigma 2-lobed.

2. **D. Californica**, Watson. Stem simple, 6 inches high or more, rather stout, from a small deep-seated tuber: leaves 2 to 4, thick, on short petioles, ovate to round-reniform, cordate or sometimes cuneate at base, obscurely sinuate-dentate or coarsely and sharply or laciniately toothed, very rarely 3-lobed: petals 4 to 6 lines long, rose-color; sepals purplish, not half as long: pods 12 to 18 lines long by a line wide, attenuate into a very slender style, on spreading pedicels. — Proc. Amer. Acad. xiv. 289.

Var. **pachystigma**, Watson, l. c. Pod much stouter and broader, with a very short stout style.

Sierra Nevada, Plumas County, *J. G. Lemmon*, *Mrs. Austin*, *Mrs. Ames*. Referred to under *Cardamine pauciseeta*.

Page 30. **5. CARDAMINE.**

2ª. **C. hirsuta**, Linn. Plumas County, *Mrs. Austin*.

4. **C. Breweri**, Watson. On Mad River, Humboldt County, *V. Rattan*.

4ª. **C. bellidifolia,** Linn. Alpine, dwarf and tufted, 2 or 3 inches high, glabrous: leaves mostly radical, ovate, entire, 2 to 5 lines long, on slender petioles: pods (1 to 5) erect, narrowly linear, 8 to 12 lines long, beaked by the very short stout style. — Fl. Dan. i, t. 20; Torr. & Gray, Fl. i. 84.

On Lassen's Peak, at 10–11,000 feet altitude, *Mrs. R. M. Austin.* Also on the higher mountains of New England, in Arctic America, and northern Europe.

Page 31. **6. ARABIS.**

3ª. **A. canescens,** Nutt. Densely and finely stellate-pubescent, 2 to 6 inches high, tufted: leaves narrowly linear-oblanceolate to broadly spatulate, or the cauline oblong and clasping: pods glabrous, 1 to 1½ inches long and a line wide, acute and tipped by a thick nearly sessile stigma, more or less spreading or reflexed on short pedicels. — *A. puberula,* Nutt.; Hook. Icon. t. 359.

Var. (?) **stylosa.** Pubescence sometimes more villous-stellate and wanting above: pods narrower, ascending, attenuate into a short rather slender style.

Lassen's Peak (*Lemmon*), and the higher mountains of Eastern Nevada and Wyoming; the variety in Plumas County (*Mrs. Austin*), and East Humboldt Mountains, Nevada, *Watson,* n. 70.

7. **A. Holbœllii,** Hornem., and 8. **A. arcuata,** Gray, are reported from the mountains of San Diego County, *D. Cleveland.*

Page 33. **7. STREPTANTHUS.**

2. **S. tortuosus,** Kell. Humboldt County, *V. Rattan.* A form occurs with the more strict and scarcely branched stem nearly covered with round-cordate clasping leaves; *Lemmon, A. Gray.*

Page 37. **10. THELYPODIUM.**

3ª. **T. Cooperi.** Annual, glabrous and glaucous: stem erect, flexuous, branching, a foot or two high: leaves oblong-lanceolate, auricled and clasping, entire, rather thick, the lower 2 inches long: flowers small (2 or 3 lines), on very short pedicels, the petals scarcely exceeding the sepals: pods remote, 9 to 18 lines long, strongly reflexed, stout, subterete, without stipe, beaked by the short style.

On the Mohave River, *Cooper, Palmer.* Partially described after *T. flavescens.*

4. **T. brachycarpum,** Torr. Meadows, on Shasta River, abundant (*Greene*); meadows, Owens Valley (*Dr. W. Matthews*), "with the odor and taste of cabbage."

4ª. **T. ambiguum,** Watson. Biennial, stout, erect, 3 to 5 feet high, glabrous and glaucous, branching: leaves sessile, broadly auricled at base, the lower oblanceolate and coarsely sinuate-toothed or -lobed, 6 to 8 inches long, the cauline entire, ovate- to oblong-lanceolate or lanceolate: raceme loose: petals reddish purple, 5 or 6 lines long, exceeding the spreading pedicels; sepals short: stamens included: pods 3 inches long, very narrow, terete, recurved-spreading; stipe nearly 2 lines long. — Proc. Amer. Acad. xiv. 290.

Northern Arizona (*Newberry, Palmer*) to Northern Nevada (Reagan's Valley, *Watson*), and to be expected in the dry valleys of Northeastern California.

Page 42. **17. NASTURTIUM.**

3ª. **N. obtusum,** Nutt. Annual, glabrous or nearly so: stems much branched, diffusely spreading or at first prostrate, a foot long or less: leaves pinnately divided or parted, often lyrate, the oblong-roundish divisions obtusely toothed or repand: flowers minute, short-pedicelled: fruiting racemes elongated: pods ovate to linear-oblong, 1½ to 3 lines long, exceeding the pedicels, straight or nearly so, abruptly beaked by the short style. — Watson, Bot. King Exp. 15.

San Luis Obispo (*Palmer*); on the South Fork of Kern River (*Rothrock*), and eastward.

Page 43. **18. VESICARIA.**

1. **V. montana**, Gray. Humbug Hills, near Yreka, *Rev. E. L. Greene;* Multnomah County, Oregon, *J. Howell.*

Page 44. **20. TROPIDOCARPUM.**

1. **T. gracile**, Hook. Near Auburn, Placer County, *Mrs. R. M. Austin.*

Page 45. **23. THLASPI.**

1. **T. alpestre**, Linn. On Spanish Peak, Plumas County, *Mrs. R. M. Austin;* near Yreka, *Greene;* near Waldo, Josephine County, Oregon, *V. Rattan.*

24. LEPIDIUM.

2. **L. dictyotum**, var. **acutidens**, Gray, Proc. Amer. Acad. xii. 54. Wings more produced and subacuminate, divergent. Near Yreka, *Greene.*

3. **L. oxycarpum**, Torr. & Gray, var. (?) **strictum**, Watson. Common among Live Oaks on the Mokelumne River, and in Hoopa Valley, Humboldt County, *V. Rattan*, 1878; San Francisco, *G. R. Vasey.*

4. **L. nitidum**, Nutt. Placer County, *Mrs. R. M. Austin;* The Dalles, Oregon, *Nevius;* Klickitat County, Washington Territory, *J. Howell.*

9. **L. montanum**, Nutt. On Shasta River, in alkaline soil, *Greene.*

+ + + *Introduced biennials or perennials: leaves auricled at base, not parted nor lobed.*

12. **L. Draba**, Linn. Perennial, minutely pubescent or nearly glabrous: stems a foot high or more, corymbosely branched at the summit: leaves oblong-obovate, 1 to 3 inches long, sparingly serrate or entire: petals large and conspicuous: pods cordate, not winged, turgid, beaked by a slender style.

Near Yreka, in a field long uncultivated, *Rev. E. L. Greene.*

13. **L. campestre**, Linn. Biennial, pubescent: stems stout, erect, a foot high or more: leaves lanceolate, serrate, or the lowest oblanceolate and somewhat lobed: flowers smaller: pods ovate, scabrous, broadly winged; style exceeding the wings.

Near Waldo, Josephine County, Oregon (*V. Rattan*), and likely to be found as an introduced weed in old fields in California.

+ + + + *Dwarf cespitose desert perennial.*

14. **L. nanum**, Watson. In dense mats scarcely an inch high, the very numerous short and densely leafy branches from a somewhat woody base: leaves about a line long, with broad ciliate petiole and deeply 3-lobed summit, the lobes rounded and obtuse: flowering peduncle naked, scarcely exceeding the leaves, 1 – 5-flowered: pods ovate, acute, a line long, scarcely winged or toothed at the apex, beaked by the slender style. — Bot. King Exp. 30, t. 4, fig. 5 – 7.

Head of Holmes Creek, Northeastern Nevada (*Watson*), and near Halleck's Station on the Humboldt River (*Wheeler*); probably to be found in the desert region of Northeastern California.

Page 48. **27. BISCUTELLA.**

1. **B. Californica**, Benth. & Hook. San Bernardino Mountains, *Parry & Lemmon, S. B. Parish.*

B. Wislizeni (*Dithyræa Wislizeni*, Engelm.) should be credited to Bentham & Hooker.

Page 49. **28. THYSANOCARPUS.**

4. **T. pusillus**, Hook. Plumas County, *Mrs. R. M. Austin.*

Page 51. **3. CLEOME.**

2. **C. platycarpa,** Torr. Near Yreka, abundant in alkaline soil, *Greene.*

Page 52. **4. CLEOMELLA.**

2. **C. obtusifolia,** Torr. Kern and San Bernardino Counties, *J. G. Lemmon.* Fremont's locality was probably in the same region.

Page 56. **1. VIOLA.**

4ª. **V. cuneata,** Watson. Glabrous: stem 3 to 12 inches high, slender: leaves rhombic-ovate, acute, attenuate into a slender petiole, somewhat crenately toothed above: petals deep-purple with more or less white, beardless, 4 to 6 lines long, the broad very short spur yellowish: capsule glabrous. — Proc. Amer. Acad. xiv. 290.

Coast Ranges, from Humboldt County to the Oregon line (*Rattan*), and near Shasta, *Lemmon.*

4ᵇ. **V. Hallii,** Gray, may be placed in the same group, though with divided leaves. Glabrous: stems 4 to 6 inches high, flexuous: leaves 3-parted, the divisions usually deeply 3–5-lobed or entire; segments linear or linear-lanceolate: upper petals deep purple, the lower yellow lined at base with purple, 6 to 8 lines long; spur very short and broad: capsule acute. — Proc. Amer. Acad. viii. 377.

Humboldt County (*V. Rattan*); Columbia River, Oregon, *Hall, D. M. C. Gault.*

6. **V. aurea,** Kell. From San Bernardino County (*Lemmon*) to Modoc County (*Dr. Matthews*), and the Columbia River, *Howell, Suksdorf.* — *V. Brooksii,* Kellogg, Calif. Horticulturist, ix. 281.

7. **V. Nuttallii,** Pursh. Humboldt County, *V. Rattan.*

11. **V. chrysantha,** Hook. San Diego (*D. Cleveland*); Plumas County, *Mrs. Austin.*

12. **V. Beckwithii,** Torr. & Gray. Flowers varying in their colors, the lower petals sometimes blue or bluish with yellow base, the lowest emarginate or entire: described as very fragrant.

Page 59. **1. POLYGALA.**

1. **P. cucullata,** Benth. San Diego Mountains (*Dr. E. Palmer*), to Humboldt County, *V. Rattan.*

2. **P. Californica,** Nutt. On Trinity River, *V. Rattan.*

Page 60. **1. FRANKENIA.**

1. **F. grandifolia,** Cham. & Schlecht. Known under the name of "Yerba Reuma." Sometimes a foot in height.

Page 61. Insert in synopsis of Genera: —

1ª. **Lychnis.** Calyx 10-nerved (as in *Silene*). Styles 4 or 5. Valves of capsule as many or twice as many. Alpine perennials.

1ᵇ. **Saponaria.** Calyx 5-angled, becoming 5-winged. Styles 2. Capsule 4-valved. Introduced annual.

Page 63. **1. SILENE.**

1. **S. campanulata,** Watson. Humboldt County (*Rattan*); also near Yreka (*Greene*), a form with broader ovate and oblong-ovate leaves. Stems from a thick fusiform root: flowers nearly white.

16. **S. verecunda,** Watson. On Lone Mountain (*Palmer*), and hills near San Francisco (*Bigelow, G. R. Vasey*); also collected by *Douglas* and *Dr. Andrews.* The

claws and filaments, as well as the stipe of the capsule, are more or less woolly-villous.

17ª. **S. Grayi**, Watson. Dwarf and alpine, 3 to 6 inches high, densely puberulent: leaves oblanceolate, 6 to 8 lines long, the cauline 2 or 3 pairs: flowers usually 2 or 3, erect or somewhat nodding, resembling those of *S. Douglasii*; petals rose-color, the broad blade bifid to the middle with a prominent tooth each side, and the broad claw with narrow entire auricles: capsule short, nearly sessile. — Proc. Amer. Acad. xiv. 291.

On Mount Shasta, near snow, *Brewer, Hooker & Gray, A. S. Packard, Jr.*

S. SARGENTII, Watson, l. c., collected on the Monitor Mountains, Nevada (*Prof. C. S. Sargent*), is an allied alpine species, to be distinguished by its longer linear leaves and larger flowers, the petals with laciniately toothed auricles and toothed appendages, the styles long-exserted, and the narrowly cylindrical capsule long-stipitate.

Page 66. **1ª. LYCHNIS,** Tourn.

Styles 5, rarely 4, and capsule opening by as many or twice as many teeth; otherwise as *Silene*. — Watson, Proc. Amer. Acad. xii. 248.

A genus of about 40 species, of the temperate and arctic portions of the northern hemisphere; represented in America by 11 species, mostly arctic or alpine.

1. **L. Californica**, Watson, l. c. Alpine, 2 to 4 inches high, cespitose and perennial, glandular-puberulent above: leaves linear to linear-oblanceolate: flowers 1 to 3, on slender pedicels, with ovate-campanulate calyx 4 or 5 lines long; petals with exserted obovate bifid blade lobed at each side: styles occasionally only 3 or 4: capsule shortly stipitate.

On Mount Dana (*Bolander*); above Silver Mountain Pass (*Brewer*), and at some station farther north, *Lemmon*.

1ᵇ. SAPONARIA, Linn. COW-HERB.

Calyx tubular-ovate or -oblong, obscurely nerved. Petals 5, with or without crown, the blade entire or emarginate. Stamens 10. Styles 2. Capsule dehiscing by 2 or 4 valves, 1-celled, or imperfectly 2–4-celled at base, many-seeded.

A genus of Europe and extratropical Asia, known in America only by a few introduced species.

1. **S. Vaccaria**, Linn. Annual, glabrous and glaucous, 1 or 2 feet high, with spreading branches: leaves lanceolate, sessile and clasping, the lower oblanceolate: calyx angled, becoming 5-winged, purple-tipped: petals pale red, exserted, entire, without crown. — *Vaccaria vulgaris*, Host.

Butte County (*Mrs. J. Bidwell*); Camp Bidwell (*Dr. W. Matthews*).

S. OFFICINALIS, Linn., a stout spreading perennial, with large clustered rose-colored often double flowers, is common eastward and to be expected in California. Calyx tubular, terete: petals emarginate, bearing a slender crown. Known as Soapwort or Bouncing Bet.

Page 67. **2. CERASTIUM.**

2ª. **C. viscosum**, Linn. Annual, viscid-pubescent, suberect, 3 to 12 inches high: leaves ovate or obovate to oblong-ovate, ½ to 1 inch long: flowers in close clusters: petals equalling the lanceolate acuminate narrowly margined sepals, 1½ to 2 lines long, usually much exceeding the pedicels: capsule at length much exserted, narrow, nearly straight. — *C. vulgatum*, of the Manuals.

Auburn, Placer County, *Mrs. R. M. Austin*. A European species, widely naturalized.

2ᵇ. **C. vulgatum**, Linn. Resembling the last, but perennial, with oblong leaves, and with somewhat larger flowers on longer pedicels: sepals 2 or 3 lines long, less acute, and with a broader margin: capsule broader. — *C. viscosum*, of the Manuals.

Plumas County, *Mrs. Austin*. The common Mouse-ear Chickweed of the east and Europe.

3. **C. pilosum,** Ledeb. Humboldt County, common in thickets, *V. Rattan.* Petals bifid.

Page 67.

3. STELLARIA.

2. **S. nitens,** Nutt. Plumas County, *Mrs. R. M. Austin.*

5ª. **S. crispa,** Cham. & Schlecht. Glabrous, much resembling *S. borealis:* leaves ovate to oblong-ovate, acute or shortly acuminate, 3 to 10 lines long: flowers solitary in the axils or few in a terminal cyme. — *S. borealis,* var. *crispa,* Fenzl.

Near Calaveras Grove and on Mount Shasta (*Hooker & Gray*); Plumas County (*Mrs. Austin*); northward to Alaska.

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4. ARENARIA.

5. **A. Californica,** Brewer. Chico, *Mrs. J. Bidwell.* Plains about Yreka (*Rev. E. L. Greene*), a small form with acuminate sepals exceeding the small petals. The seed appears to be smooth or nearly so.

6ª. **A. verna,** Linn. Perennial, cespitose, 1 to 3 inches high, glabrous or pubescent: leaves linear-subulate, nerved, erect, 2 or 3 lines long, acute: bracts herbaceous: sepals lanceolate, acuminate, 3-nerved, 2 lines long, a little exceeding the petals, about equalling the capsule.

Var. **hirta,** Watson. Shortly hirsute throughout.

Lassen's Peak (*Mrs. R. M. Austin*); the variety. Mountains of Colorado and Utah, and northward to Arctic America; Mount Mansfield, Vermont; Northern Europe and Asia.

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5. SAGINA.

2. **S. Linnæi,** Presl. Manachi Meadows, Kern County, *Rothrock.*

Page 71.

7. LEPIGONUM.

1. **L. macrothecum,** Fisch. & Mey. Humboldt Bay, *Rattan.* Flowers pink.

Page 72.

9. LŒFLINGIA.

1. **L. squarrosa,** Nutt. Sierra Valley, *J. G. Lemmon.*

Page 75.

2. CALANDRINIA.

5ª. **C. Leana,** Porter. Glabrous acaulescent perennial, with very thick branching rootstock: leaves numerous, all radical, linear-oblanceolate, thick and fleshy, 1 to 1½ inches long: stems naked or with a few glandular-ciliate bracts, a foot high or less, diffusely paniculate-branched above: sepals rounded, glandular-ciliate; petals 6 to 8, red, cuneate-obovate, 3 to 6 lines long: stamens as many: capsule oblong-ovate: seeds shining. — Coult. Bot. Bull. i. 49.

Mount Shasta, Little Castle Lake (*Helen S. Wright*); Siskiyou Mountains, near Jackson Lake (*Greene*); Jackson County, Oregon (*L. W. Lee*); also on Saddle Mountain, near Astoria, Oregon (*J. W. Marsh*), and on the Eastern Cascade Mountains, lat. 49°, *Dr. Lyall,* 1860.

Page 76.

3. CLAYTONIA.

1ª. **C. exigua,** Torr. & Gray. (Substitute for **C. perfoliata,** var. **exigua.**) Low, glaucous, very fleshy and succulent: leaves terete or slightly flattened above, the cauline linear or oblong, or very short and orbicular-connate about the stem: petals white to rose-color, 1½ to 3 lines long: seeds dull, minutely tuberculate.

From the Lower Sacramento region to the Columbia.

2ª. **C. bulbifera,** Gray. Closely allied to *C. Sibirica:* perennial by crowded bulblets at the base of the radical leaves, which are ovate-lanceolate to lanceolate, attenuate at base, acute or acuminate: stems lax, ½ to 3 feet high, with a pair of

ovate to lanceolate sessile or shortly petiolate leaves and the long divaricate pedicels of the elongated raceme subtended by conspicuous herbaceous spatulate or linear-oblong bracts: flowers usually large (4 lines long), the broad sepals much dilated in fruit. — Proc. Amer. Acad. xii. 54.

Scott Mountains, Siskiyou County (*Rev. E. L. Greene*); also apparently, but without the bulbiferous base, from Saucelito (*G. R. Vasey*), Noyo (*Bolander*), Mount Shasta (*Hooker & Gray*), and Lassen's Peak, *Mrs. R. M. Austin*.

5ª. **C. dichotoma**, Nutt. Low and slender, 1 to 3 inches high, branching from the base and above: leaves linear, an inch long or less: flowers racemose, small; sepals a line long or less; petals unequal: stamens 3: seeds small, minutely tuberculate, dull. — Torr. & Gray, Fl. i. 202.

Near Yreka, Siskiyou County (*Greene*), and northward to the Columbia. With the habit of *Montia*, but petals distinct. The seeds of *C. linearis* are large and shining.

6. **C. diffusa**, Nutt. Humboldt County, *V. Rattan*.

8 **C. triphylla**, Watson. Eagle Creek Mountains, Union County, Oregon (*W. C. Cusick*), and Simcoe Mountains, Washington Territory, *J. Howell*.

10. **C. Nevadensis**, Watson. Plumas County, *Mrs. Austin*. Rootstock thickened or slender.

Page 77. **5. SPRAGUEA.**

1. **S umbellata**, Torr. Head of South Fork of King's River, *Matthews*.

Page 78. **6. CALYPTRIDIUM.**

2. **C. roseum**, Watson. Near San Bernardino, *Dr. C. C. Parry*.

Page 80. **1. ELATINE.**

1. **E. Americana**, Arn. Leaves obovate and very obtuse: flowers sessile, closed or sometimes expanded and remaining so, purplish: stamens 2 or sometimes 3, as many as the petals and sepals: seeds cylindrical, slightly curved, about a third of a line long, very minutely pitted in 9 or 10 longitudinal lines (20 or 30 pits in each line). — Gray, Proc Amer. Acad. xiii. 361.

The more common American species, found on the Columbia River (*Hall, Howell*), but not collected in California.

2. **E. brachysperma**, Gray, l. c. Mostly terrestrial, sometimes submersed or floating: leaves oblong or oval and attenuate at base or sublanceolate: flowers sessile, mostly dimerous; stamens 2 or 3: seeds short-oblong, nearly straight, not over a fourth of a line long, more coarsely pitted in 6 or 7 lines of 10 to 12 pits.

California, *Kellogg & Harford*, n. 257; locality not noted. Also from Illinois and Texas.

3. **E. Californica**, Gray, l. c. Floating: leaves obovate, attenuate at base, the lower with a petiole not longer than the blade: flowers shortly pedicellate, with 3 or 4 sepals and petals and twice as many stamens: seeds circinate-incurved, nearly a third of a line long, minutely pitted in 10 or 12 lines (about 25 pits to each line).

In Sierra Valley, *J. G. Lemmon*. The only American representative of the section *Elatinella*.

2. BERGIA.

1. **B. Texana**, Seub. On the Columbia River, *J. Howell*.

Page 81. **1. HYPERICUM.**

2. **H. concinnum**, Benth. In the Coast Ranges north of San Francisco; Russian River, *V. Rattan, G. R. Vasey*.

Page 83. **1. LAVATERA.**

1. **L. assurgentiflora,** Kell. Involucre 3-cleft to below the middle: calyx deeply 5 – 7-toothed, becoming 6 or 8 lines long in fruit.

2. **L. insularis,** Watson. A stout perennial, finely stellate-pubescent: leaves circular in outline, 7-lobed to the middle, the lobes rounded and obtuse, coarsely crenate-toothed: flowers solitary in the axils, on deflexed pedicels about an inch long: involucre of 3 nearly distinct oblong-spatulate acutish bracts: calyx 5-cleft to the middle with broadly ovate acute lobes, much dilated in fruit: petals spatulate, emarginate, purplish-yellow, 1½ inches long, naked at base: styles not exserted: fruit slightly pubescent, ½ inch broad, about 10-carpelled. — Proc. Amer. Acad. xii. 249.

Coronados Islands, near San Diego, *D. Cleveland.* A fourth species (*L. venosa*, Watson, l. c.) has been collected on San Benito Island, Lower California; leaves with triangular acutish lobes; flowers smaller, clustered, deep purple, with nearly distinct oblong-ovate involucrate bracts equalling the calyx, exserted styles, and glabrous fruit, the carpels strongly veined on the sides.

3. SIDALCEA.

1. **S. malvæflora,** Gray. Rarely more or less stellate-pubescent: carpels apiculate, sometimes slightly pubescent.

Page 85. **4. MALVASTRUM.**

3. **M. splendidum,** Kell. Los Angeles (*Mrs. A. E. Bush*); Bartlett's Cañon, near Santa Barbara, *Rothrock.*

5*. **M. Palmeri,** Watson. Stout, very densely stellate-pubescent, the branches somewhat flexuous: leaves broadly ovate, truncate or subcordate at base, 2 or 3 inches long, somewhat 3 – 5-lobed, the lobes obtusish, crenate-toothed; stipules lanceolate, conspicuous: flowers nearly sessile in terminal clusters; bractlets linear-lanceolate, nearly equalling the acuminate calyx-lobes: petals yellowish rose-color, an inch long: carpels rounded, somewhat pubescent. — Proc. Amer. Acad. xii. 250.

At Cambria, San Luis Obispo County, a mile from the beach, *Palmer*, n. 90, 1876.

Page 87. **8. HIBISCUS.**

1. **H. Californicus,** Kell. Flowers white changing to light rose-color. Differing from the eastern *H. Moscheutos* chiefly in its less acuminate leaves, cordate at base, and less white beneath.

Page 88. **1. FREMONTIA.**

1. **F. Californica,** Torr. Known locally as "Slippery Elm," the inner bark being used as a substitute for that of *Ulmus fulva.* — Rothrock, Bot. Wheeler's Expl. 357.

2. AYENIA, Linn.

Flowers very small, naked. Calyx 5-parted. Petals 5, with narrow incurved claws, the cucullate-concave blade adnate to the urceolate stamineal tube. Anthers 5, 3-celled, alternate with 5 staminodial lobes and opposite to the petals. Ovary 5-celled; cells 2-ovuled: stigma capitate. Capsule muricate, separating into 5 1-seeded 2-valved carpels. Seeds transversely rugose, without albumen. — Herbs or shrubs, with simple serrate leaves, small stipules, and flowers in small axillary shortly pedunculate cymes.

A genus of warmer and tropical America, of 8 species.

1. **A. pusilla**, Linn. Perennial, branching from the woody base, the slender branches decumbent or ascending, often a foot high or more, finely pubescent: leaves lanceolate, ½ to 1 inch long, sometimes smaller and ovate, coarsely serrate, on short petioles: flowers about a line long, reddish, the petals bearing a small pedicellate gland; pedicels deflexed: capsule subglobose, stipitate, about 2 lines in diameter. — Cav. Diss. ii. 289, t. 147.

Big Cañon of the Tantillas Mountains, and on Carmen Island, Lower California (*Palmer*); Cienega, Arizona (*Rothrock*); eastward to Texas, Southern Florida and the West Indies.

A. MICROPHYLLA, Gray, Pl. Wright. i. 25 and ii. 24, is a low shrubby species of New Mexico, with small cordate leaves, the petals not glanduliferous on the back, and the ovary and capsule not stipitate.

Page 89. **1. LINUM.**

3. **L. digynum**, Gray. Near Etna, Siskiyou County, *Rev. E. L. Greene.*

4. **L. Breweri**, Gray. Lone Mountain, near San Francisco, *Palmer.*

8. **L. micranthum**, Gray. Pine Mountain, San Luis Obispo County (*Palmer*); Camp Bidwell, Modoc County (*Dr. Matthews*); near Yreka, *Greene.*

Page 91. **1. TRIBULUS.**

1. **T. grandiflorus**, Benth. & Hook. — *T. Fisheri*, Kellogg, Proc. Calif. Acad. vii. 162.

Page 94. **1. GERANIUM.**

3. **G. incisum**, Nutt. Humboldt County, *V. Rattan.*

Page 95. **3. LIMNANTHES.**

1. **L. Douglasii**, R. Br. Glabrous: petals oblong-spatulate, emarginate, yellow bordered with white, naked: fruit smooth or slightly corrugated.

1ª. **L. rosea**, Hartw. Glabrous: petals obovate and emarginate, or obcordate, light rose-color or purplish below, villous within near the base: fruit strongly tuberculate.

2. **L. alba**, Hartw. Floccose-villous: petals broad, white or nearly so, sometimes not exceeding the sepals: fruit strongly tuberculate.

Near Yreka, Siskiyou County, *Greene.* Fuller material of these species leaves no doubt of their entire distinctness.

Page 96. ORDER XXV. **RUTACEÆ.**

CASIMIROA EDULIS, Llav. & Lex. (Seem. Bot. Herald, 273, t. 51, 52), a native of Mexico and often cultivated there for its large edible fruit, the "Zapote blanco" or White Sapota, is found in old gardens near Santa Barbara. It is a small tree, with alternate digitately 3–7-foliolate leaves, the thick leaflets glabrous and entire, small green 5-merous flowers, and a large subglobose 5-seeded pulpy fruit.

Page 97. **1. PTELEA.**

1. **P. angustifolia**, Benth. Butte County, *Mrs. J. Bidwell, Mrs. Austin.*

Page 98. **1. EUONYMUS.**

1. **E. occidentalis**, Nutt. Plumas County, *Mrs. Austin.*

Page 100. **3. RHAMNUS.**

1. **R. alnifolia**, L'Her. At Truckee, Nevada County, *Hooker & Gray.*

3. **R. Californica,** Esch. "Yerba del Oso," and "California Coffee."

4. **R. Purshiana,** DC. "Cascara Sagrada." The bark of these species is collected for medicinal purposes.

Page 102. **5. CEANOTHUS.**

1. **C. thyrsiflorus,** Esch. Flowers sometimes white: leaves often more or less narrowly oblong-lanceolate, rounded or cuneate at base: fruit smooth, 1½ lines broad.

2. **C. velutinus,** Dougl. Humboldt County, south of Redwood Creek, 20 feet in height, *V. Rattan.* Fruit sometimes verrucose and glutinous, 2 lines broad.

3ª. **C. sanguineus,** Pursh. A shrub, 4 to 12 feet high, with reddish branches, glabrous or nearly so: leaves thin, ovate or elliptic, 1 to 3 inches long, obtuse or acutish, usually rounded at base, serrate; petioles slender, an inch long or less: flowers white, in thyrsoid axillary panicles 2 or 3 inches long: fruit 2 lines broad, smooth. — *C. Oreganus,* Nutt.; Hook. Bot. Mag. t. 5177.

Yreka, Siskiyou County (*Rev. E. L. Greene*); northward to British Columbia.

8. **C. divaricatus,** Nutt. Olanche Mountain, Inyo County, *Rothrock.* "Blue Brush"; frequented as a covert and for browsing by deer.

Page 107. **2. ACER.**

1. **A. macrophyllum,** Pursh. Plumas County, *Mrs. Austin.*

Page 108. **3. NEGUNDO.**

1. **N. Californicum,** Torr. & Gray. Near the Gaviote River, Santa Barbara (*Mrs. Elwood Cooper*); Fort Tejon, *Rothrock.* "Soft" or "Swamp Maple."

4. STAPHYLEA.

1. **S. Bolanderi,** Gray. Capsule rather firm, 1 to 1½ inches long, the cells carinate and attenuate into the slender style: seeds globose, 3 lines long. Collected by *J. G. Lemmon.*

Page 109. **5. GLOSSOPETALON.**

1. **G. Nevadense,** Gray. Found only in one cañon, opening upon the shore of Pyramid Lake, *J. G. Lemmon.*

Page 114. **2. PICKERINGIA.**

1. **P. montana,** Nutt. Sierra County (*Lemmon*); above Chico, *Mrs. Bidwell.*

Page 117. **4. LUPINUS.**

2. **L. Chamissonis,** Esch. — *L. sericatus,* Kellogg, Proc. Calif. Acad. vii. 92, appears to be a few-seeded form of this species.

11. **L. ornatus,** Dougl. Plumas County, *Mrs. Austin.* Sometimes decidedly woody at base.

12. **L. sericeus,** Pursh. About Yreka, abundant, *Rev. E. L. Greene.*

13. **L. leucophyllus,** Dougl. Near Yreka, *Greene.*

14. **L. Grayi,** Watson. Mountains near San Luis Obispo, and on Lassen's Peak (*Lemmon*); "plains" north of the Merced, *Mrs. A. E. Bush.*

16. **L. confertus,** Kell. San Bernardino Mountains (*Parish*); Monachi Meadows, Tulare County, *Rothrock.*

21. **L. laxiflorus**, Dougl. San Bernardino Mountains, *Lemmon.*

27. **L. Breweri**, Gray. Bear Valley, San Bernardino Mountains, *Parry.* A variable species.

30. **L. nanus**, Dougl. Plumas County, *Mrs. Austin.*

31ª. **L. trifidus**, Torr. in herb. (Substitute for **L. micranthus**, var. **trifidus**.) Resembling *L. micranthus;* flowers mostly in a single terminal whorl: lower lip of the calyx deeply 3-cleft with linear segments: pod narrower and shorter (about 6 lines long by 1½ broad), usually 5–6-seeded: seeds a line long, uniformly mottled. — Watson, Proc. Amer. Acad. xii. 250.

About San Francisco. *L. micranthus*, besides the nearly entire calyx-lip, has a pod often 1 inch long by 2½ lines broad, 6–9-seeded, the larger seeds variously mottled, but with a lighter spot around the sometimes dark eye; flowers occasionally flesh-colored.

31ᵇ. **L. citrinus**, Kell. Appears to be distinguished from the preceding by the bright orange or golden flowers: calyx described as short, the lower lip minutely 3-toothed: seeds lead-color marked with black. — Proc. Calif. Acad. vii. 93.

Near Fresno, *Dr. G. Eisen.*

37ª. **L. Arizonicus**, Watson, l. c. (Substitute for **L. concinnus**, var. **Arizonicus**.) Erect, a foot high or less, villous throughout with scattered spreading hairs: leaflets 6 to 8, linear-oblanceolate: racemes loose; bracts long and somewhat persistent: calyx rather broad at base, lower lip trifid: petals 4 or 5 lines long, deep blue or light rose-color, the broad wings exceeding the rounded standard: seeds nearly white.

Near San Bernardino (*Parry & Lemmon*); Mohave River (*Palmer*); Arizona. *L. concinnus* is much more densely villous, lower and more diffuse; leaflets broader, calyx narrow at base, flowers narrower and standard elliptical; petals usually reddish purple or the standard yellowish.

40. **L. densiflorus**, Benth. Humboldt County, *Rattan.* Known as "Sheep-poison."

42. **L. pusillus**, Pursh. Surprise Valley, Modoc County (*Lemmon*); Mohave River, *Palmer.*

Page 127. **5. TRIFOLIUM.**

3. **T. Lemmoni**, Watson. Substitute the following: Low (a foot high or less), cespitose from a thick branching rootstock, sparingly appressed pubescent or nearly glabrous: stipules acuminate, usually coarsely toothed; leaflets cuneate-obovate to oblanceolate, coarsely serrate and strongly nerved, 4 to 8 lines long: peduncles mostly terminal, exceeding the leaves: heads small, usually nodding: flowers numerous, shortly pedicellate, reflexed, 3 to 5 lines long, pale rose-color; calyx somewhat villous, half the length of the petals, the slender teeth exceeding the tube: ovary smooth, 2-ovuled.

Found on a flat in Sierra Valley, at 5,300 feet altitude, *J. G. Lemmon.*

3ª. **T. Plummeræ.** Dwarf and matted, 2 or 3 inches high, appressed hoary-pubescent: leaflets 3 to 5, oblanceolate, 3 to 5 lines long; stipules mostly scarious and inflated: peduncles shorter than the leaves: flowers few, 3 or 4 lines long, on short pedicels: calyx-teeth linear, exceeding the tube, a third shorter than the petals: ovary densely villous, 2-ovuled.

Peaks west of Pyramid Lake, at 6,000 feet altitude, *J. G. Lemmon* and *Miss Sara A. Plummer.*

9. **T. Kingii**, Watson. Scott Mountains, Siskiyou County (*Greene*); Mountains of Western Colorado, *McCauley.*

13. **T. gracilentum**, Torr. & Gray. Cajon Valley, San Diego County (*D. Cleveland*); Western Arizona, *Palmer.*

15. **T. Breweri**, Watson. Plumas County, *Mrs. R. M. Austin.* The species is perennial, and should follow *T. Bolanderi.*

22. **T. cyathiferum**, Lindl. Humboldt County *Rattan.*

26. **T. amplectens**, Torr. & Gray. Vancouver Island, *J. Macoun.* To be referred to *T. depauperatum* as a variety.

Page 134. **8. HOSACKIA.**

1. **H. incana**, Torr. Butte County, *Mrs. Austin.*

4. **H. bicolor**, Dougl. Plumas County, *Mrs. Austin.*

8. **H. grandiflora**, Benth. Valle de las Viejas, San Diego County, with dark purple flowers, *D. Cleveland.*

9. **H. rigida**, Benth. Agua Caliente, near San Bernardino, *S. B. Parish.*

11. **H. strigosa**, Nutt. Flowers often reflexed: pod pubescent, 6 – 12-seeded.

14. **H. subpinnata**, Torr. & Gray. Siskiyou County (*Greene*) and Washington Territory (*Lyall*), a much taller erect form, 1 or 2 feet high; otherwise the same.

20. **H. micrantha**, Nutt. Near San Bernardino, *Parry & Lemmon*, n. 81.

Page 140. **9. PSORALEA.**

3. **P. macrostachya**, DC. Stems sometimes somewhat glandular-scabrous: spikes "2 to 8 inches long." — Kellogg, Proc. Calif. Acad. vii. 92.

6. **P. fruticosa**, Kellogg, l. c. 91. Somewhat shrubby, low and spreading, more or less white-pubescent throughout with soft hair: leaves on very short petioles (1 or 2 lines); leaflets oblong-obovate, cuneate, mucronate, 6 to 9 lines long; stipules subulate, 3 or 4 lines long: spikes sessile, compound, 2 or 3 inches long: flowers densely crowded, blue, 2 or 3 lines long, about equalling the persistent narrowly lanceolate acuminate bracts: pod ovate-oblong, glabrous, rugose, roughened.

Streams of Tamelpais, *F. P. McLean.* Known only from Dr. Kellogg's description.

* * * *Leaves digitately 5-foliate: nearly acaulescent.*

7. **P. Californica**, Watson. Stems very short and clustered: pubescence short, silky and appressed: petioles elongated; stipules scarious, lanceolate, deciduous; leaflets broadly oblanceolate, acutish, 9 to 15 lines long: racemes shorter than the leaves, on short peduncles, rather loose; pedicels slender: calyx silky-villous, $\frac{1}{2}$ inch long, the linear acuminate lobes a little exceeding the persistent petals: pod very thin, somewhat villous, oblong with a lanceolate beak: seed compressed, 2 or $2\frac{1}{2}$ lines long. — Proc. Amer. Acad. xii. 251.

On McGinnis' Ranch, near head of Salinas River, 25 miles from San Luis Obispo, *Dr. E. Palmer.* Allied to *P. esculenta* of the eastern plains, and probably with a similar tuberous root.

Page 142. **11. DALEA.**

6. **D. polyadenia**, Torr., var. (?) **subnuda.** Smoother; calyx scarcely villous.

Owen's Valley, *Dr. W. Matthews.*

7. **D. Californica**, Watson. Leaflets narrowly oblong to linear-oblanceolate, obtuse, 1 to 3 pairs, 1 to 4 lines long: calyx-teeth ovate to lanceolate: pod glabrous.

On White Water River, east side of San Bernardino Mountains, *J. G. Lemmon.*

8. **D. Fremontii**, Torr. Leaflets oblong-obovate to oblong-lanceolate, obtuse or acute, 2 to 5 lines long.

Owen's Valley (*Dr. W. Matthews*); Southern Utah, *W. Johnson.*

Page 143. **12. GLYCYRRHIZA.**

1. **G. lepidota**, Nutt., var. **glutinosa.** Near Humboldt Bay, very common (*V. Rattan*); the pod is like that of the typical form.

Page 146. **13. ASTRAGALUS.**

6. **A. Coulteri**, Benth. Sometimes biennial or perennial. Western border of San Bernardino County and on the Mohave (*Parry & Lemmon*), and into Arizona.

28. **A. cyrtoides**, Gray. This appears to be *A. Gibbsii*, Kellogg, Proc. Calif. Acad. ii. 161, fig. 50, which name has the priority and should be adopted.

29ª. **A. collinus**, Dougl. Hoary-pubescent, the slender flexuous stems a foot long: leaflets linear or oblong-linear, obtuse or emarginate, 6 to 11 pairs, ½ inch long: peduncles elongated; racemes short: calyx soft-pubescent, campanulate, with short triangular teeth: pod pubescent, linear-oblong, nearly straight, 8 lines long, upon a stipe twice longer than the calyx. — Gray, Proc. Amer. Acad. vi. 225.

Var. **Californicus**, Gray. Pod much larger (1½ inches long), mottled with purple. — Proc. Amer. Acad. xii. 54.

On the Columbia and the Kooskooskie; the variety near Yreka, very common in open woods, *Rev. E. L. Greene.*

33ª. **A. tricarinatus**, Gray. Stem somewhat flexuous, 1 or 2 feet high: leaflets 8 to 15 pairs, more or less scattered upon the elongated rhachis, oblong-ovate or obovate, emarginate, 2 to 4 lines long, nearly glabrous above, white-puberulent beneath: peduncles elongated, equalling the leaves: flowers few, scattered, spreading: calyx campanulate, the black subulate teeth a little shorter than the tube; petals ochroleucous, ½ inch long: pod broadly linear, coriaceous, at length strongly arcuate, an inch long or more, 2-celled, very acutely carinate on the ventral side, broadly sulcate on the back between the obtuse lobes. — Proc. Amer. Acad. xii. 56.

On the White Water, San Bernardino County, *Parry.*

41. **A. obscurus**, Watson. West's Valley, Modoc County (*Lemmon*); Union County, Oregon, *W. C. Cusick.*

Page 159. **16. LATHYRUS.**

5. **L. vestitus**, Nutt. — *L. splendens*, Kellogg, Proc. Calif. Acad. vii. 90. Differing, according to the description, only in longer pedicels and rather larger pods.

8. **L. Nevadensis**, Watson. Standard broadly oblong, emarginate, purplish; wings and keel yellowish. — *Vicia nana*, Kellogg, l. c. 89; a small form.

8ª. **L. albus.** Glabrous and somewhat glaucous: stems numerous from a thick stout rootstock, a span high or less, rather stout: stipules semisagittate, lanceolate, acuminate, with narrow acuminate auricles; leaflets 3 to 5 pairs, linear to oblong, acute at each end and cuspidate, 7 to 10 lines long; tendrils none: peduncles equalling the leaves, 2 – 3-flowered: flowers white, 8 or 9 lines long; calyx-teeth deltoid to lanceolate, shorter than the tube: pod 1½ inches long by 4 lines broad, attenuate to a short stipe: seed olive-yellow, 2 lines in diameter or more, with very small somewhat sunken hilum.

Surprise Valley, Modoc County (*J. G. Lemmon*); Union County, Oregon, very abundant on low hills, *W. C. Cusick.*

Page 167. **1. PRUNUS.**

2. **P. emarginata**, Walp. Fruit red, very bitter and astringent; *W. C. Cusick.*

2ª. **P. Fremonti.** A spiny glabrous densely branched shrub or small scraggy tree (15 feet high), with short branchlets: leaves small (4 to 8 lines long), thin,

ovate or roundish, on short slender petioles, denticulate: flowers appearing with the leaves, solitary or somewhat fascicled, 5 or 6 lines broad, on pedicels 2 or 3 lines long: calyx-lobes ciliate: ovary densely pubescent; style elongated: stone oblong, turgid, rounded on one side and with a broad ridge upon the other, 5 lines long.

Coast Ranges of Southern California; Oriflamme Cañon, San Diego County (*D. Cleveland*); San Bernardino Mountains, *Parry & Lemmon*, n. 108, 1876. Also collected by *Fremont* in 1846, locality uncertain. Flowering in March; fruit probably with little pulp.

3. **P. demissa,** Walp. Hoopa Valley, Humboldt County, *V. Rattan.*

4. **P. ilicifolia,** Walp. The fruit is light red, becoming dark purple on drying.

Page 170. **3. SPIRÆA.**

Dr. Maximowicz, of St. Petersburg, in his recent "Adnotationes de Spiræaceis" (Act. Hort. Petrop. vi. 105–261), separates from the order *Rosaceæ* the tribes *Spiræeæ* and *Quillajeæ*, of which together with the *Pomeæ* he forms an order *Pomaceæ*, intermediate between the *Rosaceæ* proper and the *Saxifragaceæ*. This new order is distinguished from the first chiefly by the dehiscent carpels or by the carpels connate with the calyx, and from the last by the indefinite stamens in alternating whorls, the outer the longest. The genus *Spiræa* itself, as ordinarily understood, is resolved by him into several distinct genera, and the American species which have been referred to *Neillia* are also made to constitute a new genus, *Physocarpus*. While not prepared to adopt all of the proposed changes, some of them at least appear judicious. The following synopsis shows the alterations made by him in the arrangement of our species.

* Carpels alternate with the calyx-lobes when of the same number.

\+ Seeds with membranaceous testa and no albumen: stipules none.

\++ Calyx persistent in fruit: stamens perigynous: carpels several-seeded.

3. **Spiræa,** Linn. Carpels cartilaginous, 1-valved, distinct. Flowers perfect, rarely polygamous. Leaves simple, serrate or incised. — S. BETULÆFOLIA, S. DOUGLASII, and S. CÆSPITOSA.

3ª. **Eriogynia,** Hook. Carpels membranaceous, 2-valved, distinct. Flowers perfect. Leaves bitternately parted. — E. PECTINATA, Hook. (*Spiræa pectinata*, Torr. & Gray). Collected on Mount Shasta, *Hooker & Gray.*

\++ ++ Calyx marcescent in fruit: stamens hypogynous: carpels few-seeded.

3ᵇ. **Aruncus,** Linn. Carpels cartilaginous, 1-valved, distinct. Flowers dioecious. Leaves repeatedly ternately divided. — A. SYLVESTER, Kost. (*Spiræa Aruncus*, Linn.)

\+ + Seeds with shining stony testa: albumen very distinct: stipules membranaceous, caducous.

4. **Physocarpus,** Maxim. Follicles membranaceous, inflated, 2-valved, distinct, often stipitate. Flowers perfect, corymbose. Leaves lobed. — P. OPULIFOLIA, Maxim., P. TORREYI, Maxim. (*Neillia opulifolia*, Benth. & Hook., and *N. Torreyi*, Watson.)

* * Carpels opposite to the calyx-lobes when of the same number.

4ª. **Chamæbatiaria,** Maxim. Follicles coriaceous, 1-valved, connate at base, several-seeded. Albumen distinct. Flowers perfect. Leaves small, coriaceous, stipulate, bipinnately dissected. — C. MILLEFOLIUM, Maxim. (*Spiræa Millefolium*, Torr.)

* * * Carpel becoming an akene. (Excluded from *Pomaceæ*.)

4ᵇ. **Holodiscus,** Maxim. Carpels alternate with the calyx-lobes, with densely silky styles, and 2 collateral pendulous ovules. Akenes membranaceous, woolly, 1-seeded. Leaves lobed, without stipules. — H. DISCOLOR, Maxim. (*Spiræa discolor*, Pursh.) Maximowicz considers this genus to be most nearly allied to *Cercocarpus*, etc.

Page 171. **5. RUBUS.**

1. **R. Nutkanus,** Moç. Summit of Tranquillon Mountain, Santa Barbara County, *Mrs. Bartlett.*

5. **R. ursinus,** Cham. & Schlecht. San Diego County, *D. Cleveland.*

Page 173. **7. PURSHIA.**

1. **P. tridentata,** DC. Rock Spring, San Bernardino County, *Palmer.* Very resinous and glandular-dotted: flowers long-pedicelled.

Page 174. **9. CERCOCARPUS.**

2. **C. parvifolius**, Nutt. Butte County, *Mrs. Austin.*

Page 178. **14. POTENTILLA.**

3. **P. Breweri**, Watson. Peaks of Webber, Sierra County (*Lemmon*); nearly glabrous, with dilated stipules and large calycine bracts nearly equalling the petals.

7. **P. Wheeleri**, Watson. — Rothrock, Bot. Wheeler's Expl. 360, t. 3, B. San Bernardino Mountains, *Parry.*

8. **P. Grayi**, Watson. — *P. Clarkiana*, Kellogg, Proc. Calif. Acad. vii. 94. Evidently a reduced form.

12. **P. palustris**, Scop. Butte County (*Mrs. J. Bidwell*); Plumas County, *Mrs. Austin.* "Stems 5 or 6 feet long, floating."

Page 181. **16. HORKELIA.**

4. **H. congesta**, Hook. Plains of Shasta River, abundant, *Rev. E. L. Greene.* Leaflets cuneate-obovate in outline, deeply cleft into 3 to 5 linear lobes.

5. **H. tenuiloba**, Gray. Mohave River, *E. Palmer.*

7. **H. purpurascens**, Watson. — Rothrock, Bot. Wheeler's Expl. 360, t. 3, A.

Page 182. **17. IVESIA.**

Stamens 5 to 20.

2. **I. unguiculata**, Gray. Bear Valley, Mohave slope of the San Bernardino Mountains, *Parry & Lemmon*, n. 104. Hairs at the base more spreading: petals with a spatulate blade.

Page 185. **19. ALCHEMILLA.**

1. **A. arvensis**, Scop. Flowers fascicled in the sheaths opposite to the petioles. — *Heterocodon minimum*, Kellogg, Proc. Calif. Acad. vii. 111.

Page 187. **23. ROSA.**

2ª. **R. spithamea.** A span high or less; stem glabrous; spines usually one or two pairs at the base of the upper leaves, slender, nearly straight: leaves few; stipules very narrow, acuminate, glandular-ciliate; leaflets 3 to 7, thin, narrowly elliptic to obovate, obtuse or acutish, serrate and glandular-serrulate, an inch long or less, the short petiolule and rhachis glandular-pubescent and the latter sparingly spinulose: flowers corymbose (4 to 6), on somewhat glandular pedicels, 1 to 1½ inches broad; calyx-tube globose-oblong, densely glandular-hirsute.

On the Trinity River, very abundant in open woods, "never more than a foot high," *V. Rattan*, July, 1878. Allied to *R. parvifolia*, Ehrh., of the Atlantic States; differing especially in the thinner spinulose-serrulate leaflets.

3ª. **R. Nutkana**, Presl. The species referred to as *R. blanda*, Ait. (*l*).

Page 188. **24. HETEROMELES.**

1. **H. arbutifolia**, Roem. Butte County, *Mrs. Austin.*

Page 190. **27ª. PERAPHYLLUM**, Nutt.

Flowers solitary or in sessile 2–3-flowered corymbs; petals orbicular, spreading: ovary usually 2- (incompletely 4-) celled; styles 2. Otherwise as *Amelanchier.*

1. **P. ramosissimum,** Nutt. A shrub, 2 to 6 feet high, very much branched, with grayish bark and short rigid branchlets: leaves narrowly oblanceolate, attenuate into a very short petiole, acute, 1 or 2 inches long, somewhat silky-pubescent, sparingly denticulate: flowers appearing with the leaves, on short pedicels becoming a half-inch long or more, pale rose-color, three-fourths of an inch broad: calyx-lobes lanceolate, about equalling the turbinate tube: styles elongated, tomentose: fruit globose, fleshy and edible, 4 or 5 lines in diameter: seeds compressed, acutely margined: cotyledons orbicular-cordate. — Torr. & Gray, Flora, i. 474.

Lassen and Modoc Counties (*J. G. Lemmon*); Blue Mountains, Oregon (*Nuttall, Cusick*); Southern Utah, *Siler, Palmer.*

Page 190. **28. CANOTIA.**

Ovary seated upon and connate with a much thickened fleshy base broader and longer than itself, with it broadly ovate. Ovules usually 6 in each cell, in 2 rows. Seeds 1 or 2 in each cell. — Gray, Proc. Amer. Acad. xii. 159; Rothrock, Bot. Wheeler's Expl. 81, t. 1.

Now referred by Dr. Gray to the *Rutaceæ*, as the nearest alliance. Traces of the oil-glands characteristic of that order are with difficulty detected in the sepals and bracts.

Page 195. **1. SAXIFRAGA.**

§ 5. *Stems somewhat leafy: leaves reniform-cordate, lobed: calyx-campanulate, coherent with the base of the ovary: stamens* 5.

10. **S. ranunculifolia,** Hook. Somewhat glandular-pubescent above, nearly glabrous below, slender, a foot high or less: leaves ½ to 1 inch broad, 3-parted, the cuneiform segments obtusely cleft; cauline leaves few, the upper simply 3-lobed or reduced to a sessile lanceolate entire bract; axils of the radical leaves bearing numerous oblong bulblets: flowers in a small corymb, white, the obovate petals twice longer than the acute calyx-lobes: calyx campanulate in fruit. — Fl. Bor.-Am. i. 246, t. 83.

Spanish Peak (*Mrs. R. M. Austin*); Kettle Falls, Washington Territory (*Douglas*); Fraser River Valley, *Macoun.* Referred to as a synonym, with doubt, under *Boykinia occidentalis.*

Page 196. **2. BOYKINIA.**

3. **B. rotundifolia,** Parry. Stem villous-pubescent and glandular, 2 or 3 feet high, leafy: leaves rounded or broadly ovate, large (2 to 4 inches broad), crenately incised and toothed, thin, nearly glabrous above, the petioles very villous, slightly dilated and hairy at base; stipules small or wanting below: peduncles axillary and terminal; flowers short-pedicelled, secund on the few elongated branches: petals little exceeding the acute calyx-lobes: calyx broadly urceolate in fruit. — Gray, Proc. Amer. Acad. xiii. 371.

Along water-courses, San Bernardino Mountains, *Parry & Lemmon,* July, 1876, n. 113.

Page 201. **8. HEUCHERA.**

3. **H. pilosissima,** Fisch. & Mey. Western Arizona, *Palmer.*

8ª. CHRYSOSPLENIUM, Linn.

Calyx-tube adnate to the ovary; lobes 4 or 5, obtuse. Petals none. Stamens 8 to 10, very short, on the margin of an evident disk. Ovary 1-celled, 2-lobed above; styles 2, short, recurved. Capsule compressed, obcordate, 2-valved at the top, with 2 parietal placentæ, many-seeded. — Low decumbent herbs, glabrous and

succulent, with petiolate crenate leaves, no stipules, and small solitary axillary shortly pedicelled flowers.

About 15 species are known in cooler and mountainous regions, chiefly of the northern hemisphere, growing in swamps and brooks. Three species are North American.

1. **C. glechomæfolium**, Nutt. Stem slender, rooting at the lower joints: leaves opposite, or the upper alternate, roundish or ovate, abruptly cuneate at base, crenate-dentate, 2 to 6 lines long, about equalling the petioles: flowers about 1 or 1½ lines long, rather exceeding the pedicels: seeds comparatively large, ovate, brown, shining. — Torr. & Gray, Fl. i. 589.

On a tributary of Redwood Creek, Klamath County, *V. Rattan*.

Page 202. **9. PARNASSIA.**

2. **P. fimbriata**, Banks. Reported in the San Bernardino Mountains, *Parish*.

Page 203. **11. CARPENTERIA.**

Calyx 5 – 7-lobed, adnate to the middle of the subdepressed 5-celled ovary. Petals imbricate in æstivation, tardily deciduous. Filaments filiform, very numerous. Style short and thick, bearing 5 oblong 2-lobed persistently connate stigmas. Capsule free except at base. — Gray, Proc. Amer. Acad. xv. 42.

1. **C. Californica**, Torr. Leaves narrowly lanceolate, the short petiole dilated at base and narrowly amplexicaul: inflorescence cymose, the peduncles subtended by ovate-lanceolate sessile bracts: flowers white, fragrant; petals cuneate-obovate, an inch long. — Kellogg, Proc. Calif. Acad. vii. 110.

On King's River, Fresno County, *Dr. G. Eisen*.

12. WHIPPLEA.

1. **W. modesta**, Torr. Humboldt County, very frequent (*V. Rattan*); Willamette Slough, Oregon, *J. Howell*.

Page 205. **13. RIBES.**

3. **R. Lobbii**, Gray. Humbug Hills, near Yreka (*E. L. Greene*); Willamette Slough, Oregon (*J. Howell*); Vancouver Island, *J. Macoun*.

Page 209. **1. TILLÆA.**

2ª. **T. peduncularis**, Smith. Much branched from the base, the ascending stems about an inch high: leaves linear-oblanceolate, 1 or 2 lines long: flowers nearly sessile, the pedicels becoming in fruit 4 to 6 lines long and very slender: carpels purplish, truncate, equalling the petals and twice longer than the triangular sepals. — DC. Prodr. iii. 382; Gay, Fl. Chil. ii. 531.

Santa Barbara, *Mrs. Elwood Cooper*, May, 1879. Chili and Buenos Ayres.

2. SEDUM.

2. **S. spatulifolium**, Hook. San Bernardino Mountains (*Parry & Lemmon*); Plumas County, *Mrs. Austin*. Petals narrowly lanceolate, 3 or 4 lines long.

4. **S. obtusatum**, Gray. Calyx broadly campanulate: leaves very thick.

6. **S. variegatum**, Watson. Stems slender, 2 to 6 inches high, from a thick tuberous rootstock: radical leaves linear-oblanceolate, attenuate at base: flowers in a spreading cyme, the petals 2 or 3 lines long, and sepals usually green. — San Diego, *D. Cleveland*; May and June.

Page 211. **3. COTYLEDON.**

2. **C. pulverulenta,** Benth. & Hook. Densely white-pulverulent: flowers secund, the corolla somewhat contracted above; petals carinate with a prominent mealy-glaucous midvein, about 7 lines long.

3. **C. lanceolata,** Benth. & Hook. Leaves usually slightly mealy, lanceolate with an acutish edge, those upon the flowering stems (naked below) all broadly triangular-ovate; floral bracts 2 or 3 lines long, about equalling the stout pedicels: calyx very broad and truncate at base, 2 or 3 lines long: petals orange with prominent glaucous midvein.

4. **C. farinosa,** Benth. & Hook. Short-caulescent, usually densely mealy, a span high or more: leaves oblong-lanceolate, short-acuminate, with obtuse margin, the upper broadly ovate: calyx narrow, the triangular-ovate sepals about 2 lines long: petals pale lemon-yellow, not carinate, the midvein not prominent nor glaucous, 4 or 5 lines long.

6. **C. laxa,** Benth. & Hook. Basal leaves loosely spreading, lanceolate, attenuate above, the margin acutish, somewhat purplish: racemes simple or branched: pedicels 2 to 8 lines long: sepals about 2 lines long; petals orange-yellow, carinate with a prominent glaucous midvein, scarcely spreading at the apex.

8. **C. Palmeri,** Watson. Caulescent: leaves not at all mealy nor glaucous, reddish, lanceolate and acuminate (narrowing gradually from the base to a very sharp point), 2 inches long by 8 or 9 lines wide at base, the margin obtuse: flowering stem a span long, red, with scattered broadly triangular-ovate leaves, the lower more acuminate: racemes few, simple, secund, spreading, somewhat glaucous; pedicels 3 to 6 lines long: calyx rather broad; sepals triangular-ovate, 2 lines long; petals pale yellow, scarcely carinate, the midvein not glaucous, 5 or 6 lines long: carpels 4 lines long, at length somewhat spreading, the styles divergent. — Proc. Amer. Acad. xiv. 292.

Near San Simeon Bay, *Dr. E. Palmer*, 1877.

9. **C. Lingula,** Watson, l. c. Much like the last. Leaves oblong, acute, 2 or 3 inches long by an inch broad: stems 1½ to 2 feet long, the branches of the cyme short and less spreading; pedicels a line long or less: sepals narrower and longer: carpels 3 lines long, somewhat spreading, the styles straight.

From the same region and collector. The above descriptions and notes upon the different species are based upon specimens in cultivation at the Botanic Garden of Harvard University.

Page 214. **1. AMMANNIA.**

1. **A. latifolia,** Linn. — *Ludwigia scabriuscula,* Kellogg, Proc. Calif. Acad. vii. 78, apparently.

2. **A. humilis,** Michx. Low: leaves narrowly oblanceolate or somewhat spatulate, attenuate into a short petiole: flowers 1 to 3 in each axil, sessile: style very short.

Yosemite Valley (*J. G. Lemmon*); Columbia River, Oregon (*J. Howell*); common in the Atlantic States and ranging to the West Indies and Central America.

Page 215. **2. MYRIOPHYLLUM.**

2. **M hippuroides,** Nutt. Near Prattville, Plumas County, *Mrs. Austin.*

Page 218. **4. EPILOBIUM.**

1. **E. spicatum,** Lam. Near Humboldt Bay, *V. Rattan.*

9. **E. glaberrimum,** Barbey. Washington Territory, *Suksdorf.*

11. **E. minutum,** Lindley. Plumas County (*Mrs. Austin*), and northward to Vancouver Island and Lake Athabasca, *J. Macoun.*

12. **E. jucundum,** Gray. Resembling *E. paniculatum*, but flowers much larger, and numerous in rather crowded panicles: calyx-tube beyond the ovary more narrowly funnelform and nearly as long as the ovary; petals broadly obcordate, deep purple, half an inch long: anthers short-linear, twice longer: style elongated. — Proc. Amer. Acad. xii. 57.

Scott Valley, Siskiyou County, abundant, *Rev. E. L. Greene.*

Page 223. **7. ŒNOTHERA.**

3. **Œ. Californica,** Watson. Stems often 2 feet long from an elongated horizontal rootstock: flowers 1½ to 3 inches in diameter, opening at night, very fragrant, white to pale pink with yellowish centre: stigma protruded from the bud a day before the opening of the flower: seeds larger than in *Œ. albicaulis* and more turgid, dark brown or more or less mottled. — San Bernardino, *W. G. Wright.*

8. **Œ. heterantha,** Nutt. Union County, Oregon, *Cusick.*

15. **Œ. strigulosa,** Torr. & Gray. Vancouver Island, *J. Macoun.*

Page 229. **8. GODETIA.**

2. **G. purpurea,** Watson. Santa Inez Mountains, *Mrs. E. Cooper.*

4. **G. albescens,** Lindl. Near Chico, *Mrs. J. Bidwell.*

6. **G. quadrivulnera,** Spach. Chico (*Mrs. Bidwell*); McCloud's River, *Lemmon.*

7. **G. tenella,** Watson. Near Yreka, *Greene.*

Page 232. **9. CLARKIA.**

3. **C. elegans,** Dougl. — *C. Eisenianu*, Kellogg, Proc. Calif. Acad. vii. 94.

10. EUCHARIDIUM.

2. **E. Breweri,** Gray. Leaves rather thick: flowers an inch long, somewhat 1-sided, the stamens and style declinate; the small middle lobe of the petal spatulate: seeds in one row in each cell.

At Panoche, Fresno County, *Gilmore;* May. Both this genus and *Eulobus* are referred to *Clarkia* by Baillon, Hist. Pl. vi. 464, 491.

Page 235. **1. MENTZELIA.**

M. ASPERA, Linn. In this species, as in the rest of the section, the limb of the calyx is divided to the base.

6. **M. Lindleyi,** Torr. & Gray. — *M. crocea*, Kellogg, Proc. Calif. Acad. vii. 110.

8. **M. tricuspis,** Gray. Capsule nearly 3-celled by the intruded thin placentæ, an inch long by 3 or 4 lines broad: seeds in 1 row in each cell, flat and horizontal, not winged, strongly and irregularly rugose, opaque and very minutely tuberculate.

Near San Bernardino, *Parry & Lemmon.* This species, together with *M. hirsutissima*, Watson (Proc. Amer. Acad. xii. 252), from Angels Island in the Gulf of California, constitute a section distinct from § *Bartonia*, characterized by the filaments dilated and bicuspidate above, the terete tubular style 3-cleft at the summit, and by differences in the capsule and seeds.

Page 239. **1. CUCURBITA.**

1. **C. perennis,** Gray. Point Capitan, Santa Barbara County, *Miss S. A. Plummer.* The name "Chili Cojote" belongs rather to a species of *Megarrhiza.*

3. **C. palmata,** Watson. Fruit smooth, 2½ or 3 inches in diameter, fibrous-fleshy with thin hard rind.

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2. MELOTHRIA.

No species of this genus appears to be found west of New Mexico and Texas. The Californian plant referred to belongs to the following genus.

2ª. ELATERIUM, Linn.

Flowers dicœcious, the male racemose, the female solitary. Calyx and corolla salverform with elongated tube, or in the male flowers sometimes more or less broadly campanulate. Stamens 1 to 3, united into a slender column, the anthers connate and the linear cells sigmoid-flexuous. Ovary ovoid, beaked, usually hispid or echinate, and more or less oblique, variously locellate; ovaries 1, 2, or more in each cell, erect or ascending. Fruit fleshy, bursting irregularly. Seeds flattened. — Herbaceous climbers, with cordate leaves entire or lobed, and slender 2 – 3-cleft tendrils.

A genus of a dozen species or more, chiefly of tropical America.

1. **E. Bigelovii,** Watson. Stems very slender, glabrous or nearly so: leaves thin, roughish-papillose beneath, hastate-cordate, the middle segment lanceolate, acute and cuspidate, 1 or 2 inches long, lateral divaricately spreading and 2-lobed, all entire or obscurely sinuate: male panicle shorter than the leaves, very slender; flowers small, less than 2 lines broad: stamens 2: fruiting pedicel from the same axil, filiform, ½ inch long or more: calyx-tube 2 or 3 lines long: ovary oblique, glabrous, apparently 1-celled and 1-ovuled. — Proc. Amer. Acad. xii. 252.

On the Lower Colorado, *Bigelow, Palmer. E. minimum,* Watson, l. c. (*Marah minima,* Kellogg, Proc. Calif. Acad. ii. 18), from Cerros Islands and Cape Saint Lucas, is a second somewhat similar species, with larger flowers, and a strongly echinate fruit less than half an inch long.

3. MEGARRHIZA.

1. **M. Californica,** Torr. Leaves usually lobed to the middle, the lobes often oblong and acuminate: sterile flowers 3 to 8 lines broad on pedicels a half-inch long or less; the fertile slightly larger, with abortive stamens: ovary spuriously 4 – 6-celled, the cells 1 – 4-ovuled: fruit bursting by 4 or 6 openings at the apex: seeds oblong or oblong-obovoid, 9 to 13 lines long.

This supplementary description is drawn from copious specimens received from *Mrs. R. F. Bingham,* Bingham's Cañon, near Santa Barbara. Respecting other species little further information has been obtained. The Spanish children are said to play with the ripe seeds of some species, using them as marbles, and call them "Chili Cojotes." A notable peculiarity in the germination of the seed is described by Dr. Gray in Amer. Journ. Sci. 3 ser. xiv. 21, the cotyledons remaining at the surface of the ground, within the seedcoat, and by the development of their connate petioles carrying the plumule and radicle to some distance under the soil. The nourishment stored in the cotyledons is soon transferred to the rapidly enlarging root, and the growth of the plumule follows from a cleft at the base of the petioles.

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1. DATISCA.

1. **D. glomerata,** Benth. & Hook. The root of this species is collected for use in medicine, as a bitter tonic, and known as "Durango Root."

Page 244.

1. MAMILLARIA.

5. **M. deserti,** Engelm. Mss. "Subglobose or oval, simple, with subcylindric deeply grooved tubercles: spines 25 to 30, straight, acicular, grayish white, the larger with reddish tips, 5 to 8 lines long; 3 or 4 of the inner spines stouter but shorter, and above these 5 or 6 intermediate ones: flowers about an inch long and wide; sepals 20 to 25 in several rows, narrowly lanceolate, aristate, fimbriate; petals

about 20 nearly in a single series, narrowly lanceolate, acuminate, somewhat fimbriate at base, light straw-color turning to purplish at the tips: stigmas 5 or 6, spreading: fruit oval, green, juicy, with obliquely obovate curved brownish pitted seeds.

"At Ivanpah, 30 miles northeast of San Bernardino, in one of the mountain ranges stretching into the desert, *S. B. Parish*. Heads 2 to 4 inches high, and 2 to 2½ inches thick; tubercles about half an inch long. This and *M. Arizonica* belong to the *M. viviparа* group, and may eventually have to be united with it." — *Engelmann.*

Page 247. **3. CEREUS.**

2ª. **C. giganteus**, Engelm. "Erect, columnar, simple or with a few erect branches toward the upper part; ribs 18 to 21; areolæ ovate-orbicular, woolly when young, bearing 12 to 16 exterior slender spines and 4 to 6 much stouter inner ones, the former ½ to 1½ inches long, the latter 1 to 2½ inches: flowers lateral near the woolly top of the stem and branches, 3 to 5 inches long and 2 or 3 in diameter, open day and night: stigmas 14 to 18, slender, greenish yellow: fruit 2½ or 3 inches long, beset with 30 or 40 small scales, woolly in their axils, bursting irregularly by 3 or 4 valves and dropping the greenish white pulp with its black seeds." — Cact. Mex. Bound. 42, t. 61, 62, and frontispiece.

Common along the Rio Colorado, on rocky slopes, and eastward through Arizona. "The woody skeleton consists of long rods, corresponding to sinuses between the ribs, in younger plants distinct, in older ones connected by a network of fibers and forming a hollow cylinder. The luscious fruit is an important article of food to the Indians." — *Engelmann.*

Page 249. **4. OPUNTIA.**

9. **O. pulchella**, Engelm. Near Pyramid Lake, *Lemmon.*

11. **O. echinocarpa**, Engelm. & Big. "Leaves 3 or 4 lines long: ovary with about 20 areolæ, very spiny: stigmas 5, spreading." — *Engelmann.*

13ª. **O. Bigelovii**, Engelm. "An erect arborescent shrub with a stout trunk, simple below and there covered only with loosely adhering dead joints, densely branching above, the ultimate joints subglobose and mostly deciduous: leaves minute, subulate, only ¾ of a line long: tubercles crowded, short, hemispherical; spines very numerous, ¾ to 1 inch long, strongly barbed, covered with yellowish-white glistening loose sheaths: flowers dirty greenish red, about 2 inches in diameter; ovary with 30 to 40 bristly areolæ; petals spatulate-obovate, obtuse; stigmas 7 or 8, green, capitate, erect: fruit with about 50 bristly but not spiny areolæ, oval, tough-fleshy, soon drying, with a very deep umbilicus and small seed-cavity, sterile or with one or few (rarely numerous) regular thick seeds. — Pacif. R. Rep. iv. 50, t. 19, fig. 1 – 7.

"Hilly margin of the desert on the east slope of San Bernardino Mountains, but not in the desert itself (*Parry, Parish*), and again on the eastern edge of the desert and into Arizona. In the latter region 10 to 12 feet high, in California rarely over 4 or 5. The woody skeleton forms a wide tubular cylinder, closely reticulated, extending only into the largest branches. Seeds circular, 1½ or 2 lines in diameter and a line thick, with a rather narrow commissural band. A peculiar feature of this species are the deciduous nearly globular ultimate joints, probably those of the later summer's growth, which withering adhere to the plant by their barbed spines, or dropping on the ground strike root or more frequently are driven about and rolled into balls by the wind, a pest and dread to men and beasts. These deciduous joints remind us of the deciduous branchlets of *Taxodium*. The leaves are remarkably small for a *Cylindopuntia*. The paucity of seeds is also a peculiarity of this curious plant." — *Engelmann.*

Page 251. **1. MESEMBRYANTHEMUM.**

2ª. **M. coccineum**, Haw. Stems erect from a woody base, with strict rigid brownish branches: leaves semicylindrical or compressed-triangular, ½ to 1½ inches long by a line broad, mucronate, pellucid-punctate: flowers terminal, erect, rose-color or scarlet: calyx broadly turbinate, 3 to 5 lines long: stamens yellow: stig-

mas 5 : capsule obconical. — Salm-Dyck, Monogr. fasc. iii, t. 33. *M. bicolorum*, Curt. Bot. Mag. t. 59.

Point Conception, Santa Barbara County, and elsewhere near the coast, *Miss S. A. Plummer.* A species from the Cape of Good Hope, common in cultivation.

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1. HYDROCOTYLE.

2. **H. ranunculoides,** Linn. f. Sauvies Island, Oregon, *J. Howell*

Page 256.

4. SANICULA.

2. **S. Menziesii,** Hook. & Arn. San Bernardino (*Parry & Lemmon*); Los Angeles, *J. C. Nevin.*

3. **S. Nevadensis,** Watson. Near Yreka (*E. L. Greene*).

5. **S. bipinnatifida,** Dougl. San Diego (*D. Cleveland*); San Bernardino (*Parry & Lemmon*); Santa Barbara, *Mrs. E. Cooper.*

5ª. **S. maritima,** Kellogg in herb. Stems stout, a foot high or more : lower leaves oblong-cordate, usually somewhat broadest above, entire or slightly 3-lobed and sparingly crenate-dentate; upper and involucral leaves palmately 3–5-parted, the broad cuneate divisions usually more or less lobed and acutely toothed : peduncles solitary or umbellate, stout, 2 or 3 inches long : involucels of several oblong entire bracts : flowers sessile, greenish, crowded in hemispherical heads : fruit (immature) naked at base, awned above with hooked bristles.

Near the coast, about San Francisco or northward, *Dr. Kellogg, G. R. Vasey.*

6. **S. bipinnata,** Hook. & Arn. Odor very offensive.

7. **S. tuberosa,** Torr. Sweetwater, San Diego County, *D. Cleveland.*

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5. DEWEYA.

2. **D. Hartwegi,** Gray. Auburn, Placer County, *Mrs. M. E. P. Ames.*

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11. BERULA.

1. **B. angustifolia,** Koch. Los Angeles, *Rev. J. C. Nevin.*

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15. GLYCOSMA.

3. **G. Bolanderi,** Gray. Plumas County, *Mrs. Austin.*

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18. LIGUSTICUM.

1. **L. apiifolium,** var. (?) **minus,** Gray. Mounts Shasta and Stanford, *Hooker & Gray.*

19. SELINUM.

2. **S. capitellatum,** Benth. & Hook. Butte County, *Mrs. J. Bidwell.*

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21. CYMOPTERUS.

5. **C.** (?) **Nevadensis,** Gray. On Mount Dana, *J. G. Lemmon.* In nearly mature fruit, sufficient to show that the plant is not a *Cymopterus.* It is nearly allied to some Rocky Mountain species that have been referred with uncertainty to *Seseli.*

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22. PEUCEDANUM.

2ª. **P. farinosum,** Geyer. Fruit glabrous, oblong-elliptic, nearly sessile, 3 lines long. — Sierra Valley, Plumas County (*Lemmon, Miss S. A. Plummer*), and northward to Washington Territory. Appearing in early spring.

4ª. **P. Hallii,** Watson. Near Yreka (*Greene*); Plumas County, *Mrs. Austin.*

9. **P. dasycarpum,** Torr. & Gray. Klickitat County, Washington Territory (*J. Howell*); Humboldt County (*V. Rattan*); San Diego County, *D. Cleveland.*

Page 272. **25. DAUCUS.**

1. **D. pusilla,** Michx. Sometimes used as a remedy for the poison of rattlesnakes under the name of "Yerba de la Bibora"; *Schumacher.*

26. CAUCALIS.

2. **C. microcarpa,** Hook. & Arn. Near Yreka, *Greene.*

Page 273. **1. ARALIA.**

1. **A. Californica,** Watson. Fruit pulpy, oblong-obovate to subglobose, obscurely 5-sided, 2½ lines long, dark purple. — Humboldt County, occasional on streambanks (*V. Rattan*); Santa Lucia Mountains, *Palmer.*

Page 274. **1. CORNUS.**

2. **C. Nuttallii,** Audub. San Bernardino Mountains, *Parry.*

3. **C. sessilis,** Torr. Fruit blue-black, with a bloom, 6 lines long; walls of the stone cellular and resinous. — Mad River, Humboldt County, *Rattan.*

6. **C. glabrata,** Benth. Chico, Butte County (*Mrs. J. Bidwell*); Yreka, *E. L. Greene,* who describes the fruit as blue when ripe.

Page 276. **2. GARRYA.**

2. **G. Fremontii,** Torr. Leaves ovate to oblong or oblong-obovate, acute at each end or obtuse and mucronate above, 1 to 3½ inches long. — Plumas County (*Mrs. Austin*); Cascade Mountains, Linn County, Oregon, *W. C. Cusick.*

Page 278. **3. LINNÆA.**

1. **L. borealis,** Gronov., var. **longiflora,** Torr. Butterfly Valley, Plumas County (*Mrs. Austin*); Scott Mountains, Siskiyou County (*Greene*); Humboldt County, south of Trinity River, *V. Rattan.*

Page 280. **5. LONICERA.**

1ª. **L. ciliosa,** Poir. Trailing or climbing: leaves ovate to oblong, glaucous beneath, ciliate, shortly petiolate, the upper connate-perfoliate, 1½ to nearly 4 inches long: flowers in approximate whorls or in a single often sessile whorl, scarlet, 1 to 1½ inches long; corolla somewhat hairy or glabrous, gibbously inflated above the narrow base, slightly bilabiate. — Torr. & Gray, Fl. ii. 5. *Caprifolium occidentale,* Lindl. Bot. Reg. t. 1457. *L. occidentale,* Hook. Fl. Bor.-Am. i. 282.

San Francisco Mountains, Arizona (*Palmer*); near Chico (*Mrs. J. Bidwell*); Humbug Mountains, near Yreka (*Greene*); Humboldt County (*Rattan*); northward to British Columbia.

Page 282. **2. KELLOGGIA.**

1. **K. galioides,** Torr. On Salmon River, Washington Territory, *W. C. Suksdorf.* Leaves lanceolate to linear: flowers "pale rose-color."

Page 283. **3. GALIUM.**

1. **G. Californicum,** Hook. & Arn. Stems low and very slender, from perennial running rootstocks: fruit glabrous or more or less hirsute, on stout reflexed pedicels a line long or less.

G. ANGULOSUM, Gray, Proc. Amer. Acad. xi. 74, from Guadalupe Island (*Palmer*), is a similar hispid species, but woody at base, the stout stems and branches prominently 5–7-angled: leaves numerous, narrowly oblong, 3 or 4 lines long, 5 to 7 in a whorl: flowers greenish white, solitary and terminal: ovary smooth on a short erect or arcuate pedicel.

2. **G. Nuttallii**, Gray. Stems usually slender and elongated, retrorsely hispid or glabrous, often naked at base: leaves usually small (1 to 3 lines long), linear to oblong, in fours, rather thin: flowers polygamo-dicœcious, the sterile cymose, the fertile solitary: fruit smooth, nearly 1½ lines broad, on erect or arcuate pedicels about a line long.

In the Coast Ranges from San Francisco to San Diego. Confounded in the former description with specimens of the following, which had not been supposed to belong to the *Relbunium* section.

2ª. (8.) **G. Bolanderi**, Gray. Usually stouter, from a thick woody rootstock, often smooth or nearly so: leaves usually larger (3 to 6 lines long), rather thick: fruit white, on slender reflexed or arcuate pedicels 2 to 4 lines long. — *G. margaricoccum*, Gray, Proc. Amer. Acad. xiii. 371, the fertile form.

In the Sierra Nevada, from the Yosemite to Sierra County; apparently also from Lake and Humboldt Counties (*Torrey, Rattan*), and San Bernardino Mountains, *Parry & Lemmon*, n. 152. Originally described from sterile specimens. *G. pubens* also probably belongs to this group.

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2. PLECTRITIS.

2. **P. macrocera**, Torr. & Gray. Fort Bidwell, Modoc County, *Dr. W. Matthews.*

Page 291. Insert in Key to the Genera: —

20ª. **Townsendia.** Low short-stemmed biennials. Akenes flattened, with subthickened margins, villous. Pappus a single series of scabrous bristles thickened toward the base. Otherwise as *Aster.*

102ª. **Crocidium.** Involucre a single row of equal scales. Receptacle conical. Pappus capillary, none in the ray. Radical leaves rosulate, cauline alternate.

106. **Centaurea.** Involucre naked. Akenes compressed. Pappus of numerous bristles.

106ª. **Carbenia.** Involucre within broad foliaceous bracts. Akenes terete, striate. Pappus of 10 outer and 10 shorter inner awn-like bristles.

107ª. **Trixis.** Involucre of 5 to 10 erect equal scales in one row, and an outer irregular series of foliaceous bracts.

108ª. **Cichorium** (before **Microseris**). Flowers blue, sessile, axillary. Akenes obscurely striate. Pappus of short chaffy scales. Erect, leafy and branching.

Page 300.

3. BRICKELLIA.

5. **B. Greenei**, Gray. Very viscidly pubescent, 1 to 1½ feet high, the stems leafy throughout: leaves thinnish, ovate, obtuse, somewhat truncate at base, very shortly petioled, unequally serrate at the sides, 9 to 12 lines long or more; those upon the branches more oblong and subentire, half as long: heads solitary, sessile at the ends of the branches, many-flowered, 7 to 9 lines long; involucral scales linear, acuminate, nearly glabrous, the outer lanceolate: akenes minutely hairy on the angles above. — Proc. Amer. Acad. xii. 58.

On the South Fork of Scott River, Siskiyou County, *Rev. E. L. Greene*, August, 1876.

6. **B. linifolia**, Eaton. Minutely glandular-puberulent, 6 to 16 inches high, with narrowly elliptic-lanceolate acute entire sessile leaves ½ to 1 inch long: heads terminal on the slender sparingly leafy branches, many-flowered, 5 to 9 lines long; involucral scales linear, acute, the outer ovate: akenes minutely hispid. — Bot. King Exp. 137, t. 15.

Yosemite Valley (*J. G. Lemmon*); Utah and Northern Arizona.

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4. ADENOSTYLES.

1. **A. Nardosmia**, Gray. Klickitat County, Washington Territory, *Suksdorf.*

Page 311. **16. APLOPAPPUS.**

1. **A. squarrosus**, Hook. & Arn. Abundant near San Diego (*D. Cleveland*); Monterey, *Hooker & Gray.*

3ª. **A. stenophyllus**, Gray. Depressed, cespitose, from a woody caudex, 2 to 4 inches high, puberulent: leaves numerous, linear-subulate to filiform, ½ to 1 inch long or more, a line wide or less, entire: flowering stems scape-like, 1-flowered: heads small; involucre glandular-puberulent, of few linear-lanceolate acute scales in 2 nearly equal series, 3 or 4 lines long: rays 9 to 12, bright yellow: akenes oblong-linear, soft-villous: pappus white, somewhat rigid. — Torr. Bot. Wilkes Exp. 347.

Lassen County (*Lemmon*); and northward to Washington Territory and Idaho.

4. **A. apargioides**, Gray. San Bernardino Mountains, *Parry.*

5ª. **A. racemosus**, Torr. Herbaceous, soft-villous becoming more or less glabrate, the erect rigid nearly simple stems a foot high or more, from a thick rootstock: lower leaves narrowly oblanceolate and petiolate, 4 or 5 inches long, the cauline narrowly lanceolate, sessile with clasping base, rather coarsely spinulose-serrate or the upper entire: branches few and short (an inch long), erect, bearing usually a single large head: involucre hemispherical, not bracteate, of numerous appressed subulate acute herbaceously tipped scales, much shorter than the pappus: rays 15 to 20, pale yellow: akenes densely silky: pappus rigid, becoming reddish. — *Homopappus racemosus*, Nutt. in Trans. Amer. Phil. Soc. 2 ser. vii. 332. *Pyrrocoma racemosa*, Torr. & Gray, Fl. ii. 244.

Scott Valley, Siskiyou County (*E. L. Greene*); Willamette River, Oregon, *Nuttall.*

7ª. **A. laricifolius**, Gray. A shrub a foot high or less, fastigiately much branched, glabrous and resinous: leaves numerous, narrowly linear-oblanceolate, 3 to 8 lines long by less than a line broad, entire, strongly resinous-punctate and at length glutinous: heads corymbose at the ends of the branches, on leafy-bracted branchlets, 4 lines long, narrow; involucral bracts few, in 2 series, linear, acute or obtusish, scariously margined, about 2 lines long: rays 4 to 6, oblong, conspicuous: disk-flowers about 12: akenes pubescent. — Pl. Wright. ii. 80.

On the Mohave River (*Palmer*); through Arizona and New Mexico.

11ª. **A. Greenei**, Gray, ined. Woody at base, a foot high or less, glabrous and minutely resinous-puberulent; branches reddish brown below, leafy: leaves oblanceolate, abruptly acute or mucronate, ½ to 1 inch long, bright green: heads few in close corymbs or solitary, narrow, 5 to 8 lines long; involucre equalling or a little shorter than the disk, of lax long-linear acuminate scales, mostly with the tip or upper half thin-herbaceous and spreading: rays 3 to 7, large; disk-flowers 13 to 16: style-branches usually much exserted.

Scott Mountains, at 9,000 feet altitude (*Rev. E. L. Greene*); Union County, Oregon, *Cusick.*

Page 315. **17. BIGELOVIA.**

3ª. **B. brachylepis**, Gray in herb. Nearly allied to *B. Cooperi;* shrubby, about a foot high, resinous-punctate and glutinous, the thick linear-filiform leaves 2 to 8 lines long, with smaller ones upon the branchlets and fascicled in the axils: heads somewhat larger, 3 to 5 lines long, 8 – 12-flowered; involucre similar: akenes linear, twice longer (2 lines long), with fewer ribs: style-appendages longer, linear.

Potrero (*D. Cleveland*) and Larken's Station, San Diego Mountains, *Palmer.*

7. **B. teretifolia**, Gray. Cuyumaca Mountains (*Palmer*); San Bernardino Mountains, *Parry.*

8. **B. paniculata**, Gray. Desert washes, base of San Bernardino Mountains (*Parry*); Union Pass, Arizona, *Palmer.*

9. **B. graveolens**, var. **glabrata**, Gray. Low grounds near the sea, 12 miles south of Santa Barbara, *Mrs. Elwood Cooper*. This species, where prevalent, is often known as "Rabbit Bush."

Page 321. **20ª. TOWNSENDIA**, Hook.

Dwarf acaulescent or depressed-branching annuals or perennials, with linear or spatulate entire leaves, and large heads of whitish or rose-colored flowers. Pappus a single series of unequal rigid scabrous bristles thickened or dilated toward the base. Akenes villous, strongly compressed, with somewhat thickened margins. Otherwise nearly as *Aster*.

Seventeen species are known, confined chiefly to the Rocky Mountain region, only the following approaching the borders of California.

1. **T. scapigera**, Eaton. Biennial, finely hoary-pubescent: leaves radical, broadly spatulate, obtuse or emarginate, an inch or two long: stems several, simple, scape-like, 2 to 4 inches high, 1–2-bracted: heads solitary, an inch broad or more, the pinkish ray flowers twice longer than the herbaceous hairy oblong-lanceolate involucral scales: pappus of the ray slightly shorter than that of the disk. — Bot. King Exp. 145, t. 17.

Modoc County, Fort Bidwell (*Mrs. Austin*); hillsides, Northern Nevada, *Watson, Wheeler, Lemmon*. Flowering in early spring.

T. FLORIFER, Gray, Ms. A similar species, with numerous stems from an annual root, often branching, leafy, subdecumbent, 4 to 8 inches high, white villous-pubescent: leaves narrowly oblanceolate, acute, long-petiolate: involucre 4 or 5 lines long, the linear acuminate bracts nearly equal. — *Erigeron (?) florifer*, Hook. Fl. Bor.-Am. ii. 20. *Aplopappus florifer*, Hook. & Arn. Bot. Beechey, 351. *Stenotus florifer*, Torr. & Gray, Fl. ii. 238. *T. strigosa*, Gray, Bot. Wilkes Exp. 344, not Nutt. Baker City, Oregon (*Nevius*); Union County, Oregon (*Cusick*), and northward to the British boundary, *Douglas, Wyeth, Lyall*, etc.

Page 322. **21. ASTER.**

4. **A. Shastensis**, Gray. Siskiyou Mountains, *E. L. Greene*; a rayless form.

14. **A. Andersonii**, Gray. Foot of Mount Whitney (*Rothrock*); Mount Shasta, *Hooker & Gray*.

15. **A. divaricatus**, Nutt. — *A. tenue*, Kellogg, Proc. Calif. Acad. vii. 114. Apparently a form of this species with reduced heads.

Page 328. **23. ERIGERON.**

7. **E. Bloomeri**, Gray. Near Yreka, *E. L. Greene*.

8. **E. ochroleucum**, Nutt. The flowers are reported as "golden yellow" (Oregon, *Nevius*) and "bright yellow" (Fraser River, *Macoun*).

11ª. **Erigeron decumbens**, Nutt. "Between *E. corymbosum* and *E. foliosum*, but with the involucre of the former: stems numerous from a slender rootstock, a span or more high, spreading or ascending from the base, leafy, bearing few or sometimes solitary short-peduncled heads; leaves all linear (lower 4 or 5 inches long, 2 lines wide): rays mostly fewer than in *E. corymbosum* and white or purple-tinged: outer pappus obscure. — Proc. Am. Phil. Soc. 2. ser. vii. 309; Torr. & Gray, Fl. ii. 178." — *Dr. Gray*.

Plumas County, on Mount Dyer (*Mrs. Austin*); Sierra County (*Lemmon*); also in Oregon.

13ª. **E. miser**, Gray. Very like *E. supplex*: stems bearing 1 to 5 smaller corymbose heads: involucral scales narrowly subulate, unequal, puberulent, about 2 lines long: rays none: akenes hirsute, 2-nerved: outer pappus manifest, bristly. — Proc. Amer. Acad. xiii. 372.

Crevices of rocks near Donner Lake (*Greene*); on Mt. Stanford, *Kellogg, Lemmon, Hooker & Gray*.

Page 332. **25. BACCHARIS.**

1ª. **B. salicina**, Torr. & Gray. Woody at base, erect, 6 to 8 feet high, smooth, not glutinous or sparingly so, much branched; branches suberect, angled: leaves thick, oblanceolate to linear-oblanceolate, entire or coarsely few-toothed, acute or acutish or sometimes obtuse, 1 or 2 inches long, the broader 3-nerved from near the narrow base: heads numerous, mostly sessile, solitary or clustered: involucre ovate-cylindrical, 2 lines long in the male heads and the pubescent oblong subrigid scales obtuse, 3 lines long in fertile heads with the inner scales narrow: pappus very minutely scabrous. — Flora, ii. 258; Rothrock, Bot. Wheeler Exp. 156. *B. salicifolia*, Nutt. Trans. Amer. Phil. Soc. vii. 337.

San Diego Mountains (*D. Cleveland*); Carisso Creek and Colorado Valley (*Newberry*), and eastward to Southern Utah, Colorado and New Mexico.

2. **B. Douglasii**, DC. At Hot Springs, Kern County, *Rothrock*.

5ª. **B. Plummeræ**, Gray. Herbaceous, tomentose-pubescent, 2 or 3 feet high, with spreading branches and subcymose inflorescence: leaves, not glutinous: leaves rather thin, linear-oblong, acute or acutish, an inch long, acutely serrate the whole length, obscurely 3-nerved: heads ovate, mostly short-pedicellate, 2 or 3 lines long, the linear-lanceolate submembranous scales acute or acuminate: pappus rather rigid, scabrous, a little exceeding the corolla and style. — Proc. Amer. Acad. xv. 48.

In wet sand near running water, Glen Loch ravine, 15 miles west of Santa Barbara, *Miss S. A. Plummer, J. G. Lemmon*.

Some apparently undescribed species occur in the San Bernardino region and near Los Angeles, of which fuller material is needed.

Page 337. **31. STYLOCLINE.**

1. **S. gnaphaloides**, Nutt. Near San Diego (*D. Cleveland*); San Bernardino Desert, *Parry*.

3. **S. filaginea**, Gray. San Bernardino County, *Parry & Lemmon*.

32. EVAX.

1. **E. caulescens**, Gray. Sometimes much reduced and very shortly caulescent, which form appears to be what is described as *Stylocline acaule* by Kellogg, Proc. Calif. Acad. vii. 112.

Page 342. **36. GNAPHALIUM.**

4. **G. ramosissimum**, Nutt. Santa Barbara, *Mrs. Elwood Cooper*.

6. **G. purpureum**, Linn. San Diego, a very small form, *D. Cleveland*.

Page 347. **43. RUDBECKIA.**

2. **R. occidentalis**, Nutt. Sierra Nevada, above Chico, *Mrs. J. Bidwell*.

Page 350. **45. WYETHIA.**

6. **W. amplexicaulis**, Nutt. Trinity County, south of Trinity River, associated with *W. angustifolia*. Collected by *V. Rattan*.

Page 351. **47. ENCELIA.**

2. **E. farinosa**, Gray. Near San Bernardino, *S. B. Parish*.

Page 353. **49. HELIANTHUS.**

4. **H. exilis**, Gray. Siskiyou County, *E. L. Greene*.

Page 356. **52. LEPTOSYNE.**

4. **L. maritima,** Gray. — *Coreopsis maritima*, Benth. & Hook.; Hook. f. Bot. Mag. t. 6241.

Page 360. **56. HEMIZONELLA.**

Disk flowers occasionally as many as four.

3. **H. minima,** Gray. Camp Bidwell, Modoc County *Dr. Matthews.*

Page 365. **57. HEMIZONIA.**

13. **H. Fremontii,** Gray. Near Chico, *Mrs. J. Bidwell.*

15. **H. mollis,** Gray. Flowers varying to yellow: Yosemite Valley, *Lemmon.*

19. **H. plumosa,** Gray. Five feet high or more: flowers whitish. Sandwaste of creek near Grayson, opposite Stockton, *Lemmon.*

Page 378. **68. ACTINOLEPIS.**

1. **A. coronaria,** Gray. San Diego, rare, *D. Cleveland.*

3. **A. mutica,** Gray. — Kellogg, Proc. Calif. Acad. vii. 131. Abundant near San Diego, *D. Cleveland.*

Page 384. **71. LASTHENIA.**

1. **L. glabrata,** Lindl. Near San Diego, *D. Cleveland.*

Page 386. **74. HULSEA.**

2. **H. heterochroma,** Gray. On Mount Grayback, near San Bernardino, *Lemmon.*

4ª. **H. Parryi,** Gray. Low (6 inches high) with leaves mostly radical, white floccose-tomentose, broadly spatulate, obtuse, deeply toothed, 2 inches long: stems simple or sparingly branched at base, somewhat glandular-villous, bearing a few scattered linear leaves: heads solitary, half an inch long; involucre glandular-pubescent, the broadly linear scales about equalling the disk: rays purple or purplish, scarcely exceeding the disk: pappus scales oblong, nearly equal, somewhat lacerate. — Proc. Amer. Acad. xii. 59.

Bear Valley, headwaters of the Mohave River, *Parry.*

5. **H. nana,** Gray. Top of Mount Grayback, San Bernardino County (*Lemmon*); Siskiyou County (*Greene*); Union County, Oregon (*W. C. Cusick*); Mount Paddo, Washington Territory, *Suksdorff.*

6. **H. vestita,** Gray. Near summit of San Jacinto Mountains, San Diego County, *S. B. Parish.*

Page 388. **76. PALAFOXIA.**

1. **P. linearis,** Lag. San Bernardino Mountains, *S. B. Parish.*

Page 391. **77. CHÆNACTIS.**

11ª. **C. suffrutescens,** Gray Ms. "About a foot high, much branched from a shrubby base, densely white-tomentose: leaves once or twice pinnately parted into a few linear entire divisions: heads solitary on long naked glabrate peduncles, rather large (¾ to nearly 1 inch high): pappus of 10 or 12 equal scales, which nearly equal the apparently white corolla."

Rocky banks of the Sacramento River, below Strawberry Valley, *J. G. Lemmon.*

Page 396. **84. PERITYLE.**

3. **P. Acmella**, Gray. This species has been identified by Mr. Hemsley with *P. microglossa*, Benth. Bot. Sulph. 119, which name is the older.

Page 399. **88. PECTIS.**

1. **P. papposa**, Gray. Rattlesnake Island, harbor of San Diego, *W. J. Fisher.* — Kellogg, Proc. Calif. Acad. vii. 162.

Page 404. **94. ARTEMISIA.**

6. **A. dracunculoides**, Pursh. Near Santa Barbara, *Mrs. Elwood Cooper.*

Page 407. **98. TETRADYMIA.**

1ª. **T. comosa**, Gray. Three or four feet high, with erect branches and branchlets, white-woolly: leaves scattered, linear, flat, often an inch long or more, cuspidate-mucronate, deciduous or becoming spinose and persistent; axillary fascicles wanting: heads in terminal corymbose cymelets: involucral scales scarcely margined: otherwise nearly as *T. spinosa.* — Proc. Amer. Acad. xii. 60.

From San Diego County (*Cleveland, Palmer*) to San Bernardino (*Parry & Lemmon, Parish*) and the Mohave region (*Palmer*), and Northwestern Nevada, *Lemmon.*

Page 415. **102. ARNICA.**

4. **A. latifolia**, Bong. Yosemite Valley, ravine near Vernal Fall, *Hooker & Gray.*

4ª. **A. viscosa**, Gray. Very viscid-pubescent: stems about a foot high, branched above or to the base: leaves all sessile, rather numerous, an inch long or less, ovate-oblong, or the upper narrowly oblong, entire: heads small, shortly peduncled, rayless, rather few-flowered: involucre about 4 lines long, the pale disk a half longer or more: akenes somewhat glandular-hispid. — Proc. Amer. Acad. xiii. 374.

Mount Shasta, at 8,000 feet altitude, *Hooker & Gray.*

A. AMPLEXICAULIS, Nutt., is another species of this group, found in the Columbia Valley and perhaps reaching Northern California. It resembles *A. latifolia*, but with about 6 pairs of ovate or oblong-ovate leaves, all sessile and clasping, coarsely toothed, usually exceeding the internodes.

Page 416. **102ª. CROCIDIUM,** Hook.

Heads many-flowered, with pistillate rays; flowers all fertile. Involucre hemispherical, naked, of a single series of nearly equal thin-herbaceous lanceolate scales. Receptacle conical, naked. Rays elongated, entire; disk-corollas tubular with campanulate 5-cleft limb. Style-branches short, flattened, broad above with triangular pubescent appendages. Akenes oblong, obscurely 5-angled, covered with thick hyaline hairs or papillæ. Pappus none in the ray, in the disk of white barbellate capillary bristles. — Annual herb, with simple stems from the base, floccose-woolly or glabrate: radical leaves rosulate, spatulate, the cauline scattered and linear: head solitary; flowers yellow. A single species.

1. **C. multicaule**, Hook. Stems several, ascending, 2 to 10 inches high, naked above: radical leaves ½ to 2 inches long, sparingly toothed: flowers bright yellow, the involucre 1½ to 3 lines long, about equalling the disk, the ray twice longer. — Fl. Bor.-Am. i. 335, t. 118.

Surprise Valley, Plumas County (*Lemmon*); Lassen County (*Mrs. Austin*); Modoc County (*Matthews*); Siskiyou County (*Greene*); northward to British Columbia. Flowering April to June.

Page 420. **104. CNICUS.**

12. **C. carlinoides,** Schrank. At end read — *Cirsium scariosum*, Nutt.

Page 421. **106a. CARBENIA,** Adans. BLESSED THISTLE.

Head many-flowered; outer row of flowers sterile, the disk perfect. Involucre ovoid-globose, the outer scales broad and foliaceous, spinose-dentate, the inner (2 or 3 rows) subcoriaceous, appressed, with a spreading spiny and spinose-dentate apex. Receptacle flat, very bristly. Akenes subterete-oblong, about 20-striate, with a crenate-dentate crown and large lateral scar. Pappus of about 20 bristles in 2 series, united in a deciduous ring, the outer rigid and awn-like, the inner small, slender and fimbriolate. — A low branching pilose annual, with alternate sinuate-pinnatifid leaves, the lobes and teeth spinose. Heads large, terminal, with yellow flowers.

A single species, of southern Europe and adjacent Africa, naturalized in western South America and Mexico, and sparingly in the United States.

1. **C. benedicta,** Adans. A foot high or more, leafy, somewhat viscid: akenes very thick, 4 lines long, with conspicuous crown; bristles of outer pappus alternate with its teeth, terete, flattened and flexible at base. — *Cnicus benedictus*, Linn.; Reichenb. Icon. Fl. Germ. xv, t. 748.

Near Healdsburg, common, *V. Rattan.*

Page 422. **107a. TRIXIS,** P. Browne.

Heads several – many-flowered; flowers all perfect. Involucre cylindrical, of an inner series of 5 to 10 erect equal scales and an outer more or less irregular series of foliaceous bracts. Receptacle small, naked or pilose. Corolla bilabiate, outer lip 3-toothed, often longer in the outer flowers, the inner narrow and 2-parted or 2-cleft. Anthers sagittate and caudate at base. Achenia oblong or linear, subterete, 5-costate, usually papillose-scabrous. Pappus of numerous slender roughish bristles in 2 or 3 rows. — Herbs or shrubs, more or less pubescent or viscid, with alternate leaves, usually corymbosely paniculate inflorescence, and yellow or whitish flowers.

About 30 species are known, of tropical and subtropical America, from the southern border of the United States and the West Indies to Buenos Ayres and Chili. Two Mexican species are found in the Rio Grande region.

1. **T. suffruticosa.** A low much-branched shrub, minutely glandular-puberulent: leaves lanceolate, attenuate at base, acute or acuminate, entire or rarely sparingly denticulate, $\frac{3}{4}$ to $2\frac{1}{2}$ inches long: heads corymbose or solitary at the ends of the branches, on stout peduncles: bracts (about 5) variable, narrowly lanceolate to ovate, 3 to 5 lines long; scales 10, subherbaceous, linear, acute or acutish, 6 lines long, strongly gibbous-thickened at base, shorter than the bright yellow flowers.

On the White Water River, eastern side of the San Bernardino Mountains (*Parry & Lemmon*); Tantillas Mountains (*Palmer*); Tucson, Arizona (*Palmer*); Camp Grant, Arizona, *E. L. Greene.* Described by Dr. Palmer as "a showy bushy plant with a strong scent of wormwood."

Page 423. **108a. CICHORIUM,** Tourn. CHICORY.

Heads several-flowered. Involucre of 8 to 10 equal erect inner scales in one row, subcoriaceous, at length concave at base and receiving the outer akenes, and surrounded at base by a few shorter unequal scales. Receptacle flattish, naked or nearly so. Akenes oblong, turgid, obscurely striate. Pappus of numerous short chaffy scales in 2 or 3 rows. — Erect branching biennial or perennial herbs, with

rather rigid branches, alternate pinnatifid or coarsely toothed leaves, and sessile axillary and terminal heads of blue flowers.

Two or three species are known, natives of the Old World. *C. Endivia*, Linn., Endive or Garden Succory, is often cultivated as a salad.

1. **C. Intybus**, Linn. Perennial, with a deep thickened root, 2 or 3 feet high, pubescent below or glabrous: leaves runcinate, the upper small, narrow, subentire: head in flower an inch broad or more.

Santa Barbara (*Miss S. A. Plummer*); native of Europe, widely naturalized in temperate and tropical regions. The root is extensively used as a substitute for coffee, or for its adulteration.

Page 435. **116. MALACOTHRIX.**

11. **M. platyphylla**, Gray. Beaver Dam, Northern Arizona, *Palmer*. Akenes 2 lines long, ash-colored, corky, striate-cylindric, truncate and pitted at the summit.

Page 442. **124. SONCHUS.**

1. **S. oleraceus**, Linn. Santa Barbara (*Mrs. Cooper*); San Diego, *Cleveland*.

Page 445. **2. NEMACLADUS.**

1ª. **N. longiflorus**, Gray. Slender branching annual, 3 to 6 inches high, with habit of *N. ramosissimus;* leaves hoary-pubescent: calyx 5-parted, free from and much shorter than the narrow oblong compressed capsule, its lobes equal: corolla tubular, strictly gamopetalous, 3 lines long, 3 or 4 times longer than the calyx: filaments more united: capsule 2 lines long, 2-valved to the base: seeds short-oval. — Proc. Amer. Acad. xii. 60.

San Diego and San Bernardino Counties, *Wallace, Parry & Lemmon, Cleveland*. This second species requires a modification of the generic character, especially as respects the adnation of the calyx to the ovary and the characters of the capsule.

Page 446. **1. GITHOPSIS.**

1. **G. specularioides**, Nutt. Plumas County, *Mrs. Ames, Mrs. Austin*.

Page 451. **1. VACCINIUM.**

3ª. **V. cæspitosum**, Michx. Dwarf and cespitose, 3 to 6 inches high, branches not angled: leaves obovate to cuneate-oblong, obtuse or rarely acutish, closely serrulate, bright green both sides, reticulately veined, 3 to 9 lines long: corolla ovate or ovate-oblong: berry glaucous-blue, sweet. — Hook. Fl. Bor.-Am. ii. 33, t. 126, and Bot. Mag. t. 3429.

Var. **arbuscula**, Gray. About a foot high, with rather broader and thicker leaves. — Syn. Fl. ii. 24.

Plumas County (*Mrs. Austin*); Mount Shasta (*Hooker & Gray*); Simcoe Mountains, Oregon (*Howell*); the variety only. The species ranges in several forms from Alaska and Hudson's Bay to California, Utah and Colorado, and the northern border States.

Page 452. **3. ARCTOSTAPHYLOS.**

The Californian species of this genus are thus rearranged by Dr. Gray in the Synoptical Flora of North America.

§ 1. *Drupe smooth, mealy: nutlets separate or separable, or irregularly coalescent.* — UVA-URSI.

* *Depressed-trailing or creeping, green, glabrous or puberulent: flowers 2 lines long, in small simple clusters: ovary and reddish fruit glabrous.*

1. **A. Uva-ursi**, Spreng. Not yet detected in California.

2. **A. Nevadensis,** Gray, l. c. 27. Branches rising from a few inches to a foot high from rigid procumbent main stems: leaves thick, obovate or oval to oblanceolate, cuspidate-mucronate, abruptly petioled, an inch long or less. — *A. Californica,* Hort. Edinb.; Garden, xv. 105?

In the Sierra Nevada from Mount Dana northward to Washington Territory, *Suksdorff.* Mentioned under *A. pungens* as the Small Manzanita.

* * *Erect low shrubs, with mostly clustered short racemes or spikes: flowers* 1 *or* 2 *lines long: leaves* ½ *to* 1 *inch long.*

3. **A. pumila,** Nutt., and 4. **A. nummularia,** Gray.

5. **A. Hookeri,** Don. A foot or two high, diffuse, puberulent or glabrate: leaves green, ovate or oval, cuspidately mucronate or acuminate, sometimes spinulose-denticulate, slender-petioled: fruit glabrous, 2 lines in diameter, reddish.

Coast Ranges, Monterey to Sonoma County. Most of the synonymy cited under *A. pungens* is to be referred to this species.

* * * *Erect shrubs or low trees, with short clustered racemes: flowers* 3 *or* 4 *lines long, and yellowish drupes* 4 *or* 5 *in diameter: leaves* 1 *to* 3 *inches long.*

6. **A. Andersonii,** Gray, and 7. **A. tomentosa,** Dougl.

8. **A. pungens,** HBK. Glabrous or minutely tomentose-pubescent, 3 to 20 feet high: leaves thick and rigid, green or glaucescent, oblong-lanceolate to round-ovate, usually mucronate-cuspidate, entire, obtuse or rounded at base, slender-petioled: pedicels glabrous: drupes smooth and glabrous: nutlets thick-walled, carinate or thickened on the back, sometimes firmly coalescent. — Nov. Gen. iii. 278, t. 259; Hook. Bot. Mag. t. 2937; Lindl. Bot. Reg. xxx, t. 17; Torr. in Emory's Rep. t. 7.

Var. **platyphylla,** Gray. Leaves pale or glaucescent, usually blunt, oblong to orbicular, 1 or 2 inches long.

From San Diego to Oregon and eastward to Utah and Mexico. The variety is the Californian and more northern form, and the common Manzanita.

§ 2. *Drupe not warty, ovoid-globose, with thin pulp and a thick solid woody or bony* 1–6*-celled nut.* — Xylococcus.

9. **A. glauca,** Lindl., and 10. **A. bicolor,** Gray.

11. **A. Clevelandi,** Gray. More pubescent: leaves sessile, narrower, acuminate, the margins more revolute: inflorescence leafy: bracts and sepals acute: corolla 4 lines long, equalled by the pedicels: fruit unknown. — Proc. Amer. Acad. xii. 61.

Potrero, San Diego County, *D. Cleveland.* Flowering in September.

§ 3. — Comarostaphylis. 12. **A. polifolia,** HBK.

Page 455. **5. LEUCOTHOE.**

1. **L. Davisiæ,** Torr. Seeds pendulous, oblong, flat, the thin reticulated coat much larger than the oval nucleus, and its margin densely fimbriate with clavate-oblong hair-like cells. — Gray, Syn. Fl. ii. 34.

Page 456. **7. BRYANTHUS.**

1. **B. Breweri,** Gray. Mount San Bernardino, at 12,000 feet, *W. G. Wright.*

Page 458. **10. RHODODENDRON.**

1. **R. Californicum,** Hook. Found by *Rattan* 16 feet high or more.

Page 461. **15. ALLOTROPA.**

1. **A. virgata,** Torr. & Gray. In spruce forests near the Trinity River, *Rattan.*

Page 463. **19. PLEURICOSPORA.**

1. **P. fimbriolata**, Gray. Plumas County (*Mrs. Austin*); Mount Shasta, *Lemmon*.

20. NEWBERRYA.

Sepals 2 or 4, linear. Corolla tube villous within, as well as the filaments and style. Teeth of hypogynous disk deflexed between the stamens. — Gray, Proc. Amer. Acad. xv. 44.

1. **N. congesta**, Torr. Flowers densely cymosely crowded: corolla-lobes ovate, one-third the length of the suburceolate cylindrical tube: filaments equalling the slender style; anthers narrowly oblong, dehiscing by a slit close to the connective. — Gray, l. c.

In spruce forests on the North Fork of Mad River, Humboldt County (*Rattan*); DesChutes Valley, Oregon, *Newberry*.

2. **N. spicata**, Gray, l. c. Cauline scales narrowly oblong, acutish, more fimbriate-erose: flowers spicately crowded: corolla more campanulate, the oblong lobes a half shorter than the tube: filaments shorter than the style, which is scarcely longer than the ovary; anthers short-oblong, the cells dehiscing by a slit a little distant from the connective.

Humboldt County, near the locality of the last but at a higher altitude (*Rattan*); Washington Territory, *Gibbs*.

Page 468. **3. ANDROSACE.**

1. **A. septentrionalis**, Linn., var. **subulifera**, Gray. Calyx-lobes slender-subulate, as long as the tube, surpassing the corolla. — Syn. Fl. ii. 60.

Near Crafton, San Bernardino County (*Lemmon & Parry*); Colorado.

Page 472. **2. FRAXINUS.**

1. **F. dipetala**, Hook. & Arn., var. **brachyptera**, Gray. A form with short obovate fruit, 6 to 9 lines long, the terminal part of the wing only half the length of the body. — Syn. Fl. ii. 174.

Var. **trifoliolata**, Torr. Leaves 1–3-foliolate; leaflets small, an inch long or less, coriaceous, obsoletely serrate: fruit rather small. — Bot. Mex. Bound. 167.

The first form near Borax Lake (*Torrey*), the second near the southern boundary, in Lower California, *Parry*.

Page 473. **3ª. AMSONIA,** Walt.

Calyx small, 5-parted, with narrow acuminate segments. Corolla salverform, the cylindrical tube unappendaged, constricted and villous within at the throat. Stamens included, the short filaments inserted near the throat and the anthers free from the stigma. Carpels distinct, connected only by the common filiform style and becoming slender terete or torose erect several-seeded follicles. Stigma truncate-capitate, appendaged beneath by a reflexed cup-like membrane. Seeds in one row, oblong or cylindrical, obliquely truncate at each end, with corky testa. — Erect perennial herbs, with alternate leaves and blue flowers in terminal subthyrsoid or corymbose cymes. — Gray, Syn. Fl. ii. 81.

A genus of half a dozen North American species, chiefly confined to the southern portion of the United States, with a single species in Japan. The genus differs from the other Californian representatives of the order, in its alternate leaves, salverform corolla, free anthers and naked seeds.

1. **A. brevifolia**, Gray. About a foot high, glabrous: leaves ovate to lanceolate, 8 to 18 lines long, nearly sessile: calyx 2 or 3 lines long: corolla-lobes ovate-oblong,

nearly half the length of the clavate tube: stigma bi-apiculate: follicles 2 or 3 inches long, irregularly moniliform, 1 – 4-seeded, at length breaking into 1-seeded joints: seed 5 lines long. — Proc. Amer. Acad. xii. 64, and l. c.

Mohave Desert (*Palmer*, n. 435); Northern Arizona and Southern Utah, *Mrs. A. P. Thompson, Palmer, Parry.*

Page 475. **1. ASCLEPIAS.**

3. **A. Mexicana,** Cav. Substitute for **A. fascicularis,** Decaisne, which is identified with the Mexican species by Dr. Gray. — Icon. i. 42, t. 58; Gray, l. c. 96.

7. **A. erosa,** Torr. (Substitute for **A. leucophylla,** Engelm.) Founded upon a glabrate state, as Engelmann's upon the canescent-woolly form.

Var. **obtusa,** Gray, l. c. A form with elliptical and very obtuse leaves and scanty woolliness. — *A. leucophylla*, Engelm., var. *obtusa*, Gray, Bot. Calif. i. 620.

Bartlett's Cañon, near Santa Barbara, *Rothrock.*

8. **A. Fremonti,** Torr. Canescently tomentose, with short fine wool, or the stem puberulent, a foot high or less: leaves oblong or ovate-oblong, subcordate at base, obtuse or acute, entire, distinctly petioled, 3 or 4 inches long: umbels 1 to 3, on peduncles not longer than the woolly pedicels: corolla whitish, the oblong-ovate lobes 3 lines long: hoods nearly erect, equalling the anthers, somewhat evenly truncate, the inner angles produced into a tooth; horn broad, the subulate exserted apex incurved. — Gray, Syn. Fl. ii. 93.

On the Upper Sacramento (*Fremont, Newberry*); near Chico (*Mrs. J. Bidwell, Hooker & Gray*); near Little Lake, Mendocino County, *Rattan.*

+ + + *Hood mainly solid, laterally compressed with narrow dorsal keel and broader ventral wing; the latter bearing two semi-obovate lamellæ enclosing a broad crest which is produced into a short subulate exserted horn.*

9. **A. nyctaginifolia,** Gray. Roughish-puberulent, ascending, apparently a foot high: leaves rhombic-ovate, 2 or 3 inches long, rather long-petioled: umbels lateral, very shortly peduncled, 4 – 8-flowered; pedicels equalling the peduncle: corolla greenish, the oblong lobes 6 lines long: column very short: hoods little shorter than the petals, nearly twice longer than the anthers; exserted horn a line long. — Proc. Amer. Acad. xii. 70, and Syn. Fl. ii. 95.

At Rock Spring, Providence Mountains, *Palmer.*

Page 477. **2ª. SCHIZONOTUS,** Gray.

Hoods saccate, oval, cleft on the back from apex to base, the ventral side adnate the whole length to the column. Anthers, etc., of *Acerates.* Leaves opposite. — Gray, Proc. Amer. Acad. xii. 66, and Syn. Fl. ii. 86, 100.

A single species, separated from *Gomphocarpus* and from *Acerates* by the strictly dorsal fissure of the hood.

1. **S. purpurascens,** Gray, l. c. — *Gomphocarpus purpurascens*, Gray, Proc. Amer. Acad. x. 76, and Bot. Calif. i. 477.

3. PHILIBERTIA, HBK.

Calyx minutely 5-glandular within. Corolla open-campanulate or (in our species) rotate and deeply 5-cleft or -parted; lobes commonly ciliate, narrowly overlapping. Crown double, the outer a membranous ring adnate to the base of the corolla, the inner of 5 fleshy or hood-like scales adnate to the base of the stamineal column. Stigma flat or umbonate or with a short 2-cleft beak. Follicles rather thick, smooth, acuminate. — Perennial herbaceous or shrubby twining plants, with opposite petio-

late leaves and dull-colored fragrant flowers: peduncles umbellately several – many-flowered.

An American genus of about 30 species, inhabiting tropical and subtropical regions from the southern border of the United States to Buenos Ayres. Five species are included in Gray's Synoptical Flora. Formerly included in *Sarcostemma*, which is restricted by Bentham & Hooker to the Old World species.

1. **P. linearis**, Benth. & Hook. Slender, low-twining or when young erect, puberulent or glabrate: leaves narrowly linear, acute or acutish at each end, an inch long, shortly petioled: peduncle 8 – 10-flowered, exceeding the leaves: corolla slightly puberulent, with ovate lobes, yellowish, purplish, or whitish, 4 lines broad; crowns contiguous: column none or very short. — Gray, Syn. Fl. ii. 88. *Sarcostemma lineare*, Decaisne, Pl. Hartw. 25, and DC. Prodr. viii. 539.

Var. **hirtella**, Gray, l. c. Cinereous-pubescent throughout with short spreading hairs, slightly climbing: sepals more slender. — *Sarcostemma heterophyllum*, var. *hirtellum*, Gray, Bot. Calif. i. 478.

Var. **heterophylla**, Gray. — *Sarcostemma heterophyllum*, Engelm.

The varieties from Southern California to Arizona; the typical form Mexican ranging into Arizona.

4. GONOLOBUS, Michx.

The American species of *Lachnostoma* are now referred by Dr. Gray to this genus, which differs from our other *Asclepiadaceæ* in its unappendaged anthers borne on or under the margin of the stigma and dehiscing transversely, the pollen masses horizontal or nearly so. — Perennial twiners, with opposite leaves and umbellate or fascicled dull-colored flowers. — Gray, Proc. Amer. Acad. xii. 75, and Syn. Fl. ii. 102.

About 80 or 90 species all American, 15 in the southern United States.

1. **G. hastulatus**, Gray, l. c. — *Lachnostoma hastulatum*, Gray, Bot. Calif. i. 620.

Page 479. **ERYTHRÆA.**

2. **E. trichantha**, Griseb. Santa Catalina Island, *Dr. Schumacher.*

Page 483. **3. GENTIANA.**

7ª. **G. Oregana**, Engelm. Rather stout, 1 or 2 feet high: leaves ovate or ovate-oblong, 1 to 1½ inches high: flowers few at the summit or occasionally several and racemosely scattered: bracts oblong or ovate: calyx-lobes oblong- to ovate-lanceolate, equalling the tube: corolla broadly funnelform, over an inch long, with short roundish lobes. — Gray, Syn. Fl. ii. 122. *G. affinis*, var. *ovata*, Gray, page 482.

From near San Francisco (*Bolander*) to British Columbia.

Page 484. **4. FRASERA.**

4. **F. albicaulis**, Dougl. Very minutely pruinose-puberulent: sepals rather longer and narrower than in *F. nitida*: corolla-lobes ovate-lanceolate and acuminate: gland oblong-linear: scales between the filaments more or less dissected into bristle-like processes: otherwise as *F. nitida*. — Griseb. in Hook. Fl. Bor.-Am. ii. 67, t. 164; Gray, Syn. Fl. ii. 126.

Near Fort Bidwell, Modoc County (*Dr. W. Matthews*); northward in Oregon and Idaho.

Page 486. **1. PHLOX.**

2. **P. longifolia**, Nutt., var. **brevifolia**, Gray. Substitute for var. **Stansburyi**, which is a stouter form with linear to linear-lanceolate leaves, occurring frequently in Nevada and Utah, but not yet observed in California.

2ª. **P. adsurgens,** Torr. Glabrous except the glandular-pubescent peduncles and calyx: stems slender, ascending from a prostrate or rooting base, 6 to 8 inches high: leaves ovate to ovate-oblong, acute, sessile, 5 to 10 lines long, rounded or narrowed at base: corolla-tube 6 to 8 lines long, twice the length of the calyx, its lobes obovate, entire: ovules solitary in each cell. — Gray, Proc. Amer. Acad. viii. 256, and Syn. Fl. ii. 133.

Mountains south of Trinity River (*Rattan*); Cascade Mountains, Oregon, *A. Wood, Cusick.*

Page 488.

2. COLLOMIA.

8. **C. aggregata,** Porter. — Bot. Wheeler Exp. 198; Gray, Syn. Fl. ii. 394. *Gilia aggregata,* Spreng.; Bot. Calif. i. 496. The frequently unequal insertion of the stamens upon the tube of the corolla, detected by Prof. Porter, necessitates the transfer of this common species from *Gilia* to *Collomia.*

Page 489.

3. GILIA.

1. **G. demissa,** Gray. — Rothrock, Bot. Wheeler Exp. t. 19, B.

1ª. **G. Parryæ,** Gray. Dwarf (1 to 4 inches high), at length much branched, pubescent: leaves 5–7-parted, the linear-acerose divisions 1½ to 3 or 4 lines long: calyx deeply 5-cleft, 3 to 5 lines long, the lobes acerose-pointed, with broad scarious ciliate margins: corolla white, yellow or purple, ½ inch long, with broadly ovate lobes much exceeding the broad tube and each crowned at base by a broad adnate emarginate scale: capsule oval-oblong, many-seeded. — Proc. Amer. Acad. xi. 76, and Syn. Fl. ii. 137. *G. Kennedyi,* Porter, Coult. Bot. Gaz. ii. 77.

Southern California; San Bernardino County (*Parry & Lemmon*); Mohave region (*Palmer*); Kern County (*Kennedy*); Inyo County, *Matthews.*

1ᵇ. **G. Lemmoni,** Gray in herb. Simple or branched, about 2 inches high, subglandular-hispid: leaves mostly 5-parted, the narrow acutish divisions 1 or 2 lines long: calyx cleft to the middle, 2 lines long, scarious between the prominent ribs which are acerose-pointed and spreading above: corolla yellowish, 3 or 4 lines long, with rather narrow abrupt tube shorter than the calyx and several times shorter than the lobes; anthers oblong: capsule narrowly oblong, nearly equalling the calyx, many-seeded.

San Bernardino County (*Parry & Lemmon,* n. 243); Los Angeles, *Rev. J. C. Nevin.* Intermediate between the sections *Dactylophyllum* and *Leptosiphon.*

4. **G. Bolanderi,** Gray. Siskiyou Mountains, *Rattan.*

9ª. **G. brevicula,** Gray. Resembling *G. androsacea;* 4 inches high, simple or with spreading branches, minutely pubescent and above glandular: leaves 3 lines long or less: calyx cleft a third of its length, the lobes acute (not acuminate nor ciliate): corolla-tube 5 to 7 lines long, twice longer than the calyx and bracts; lobes purple or violet or whitish, darker at the throat. — Proc. Amer. Acad. xii. 79, and Syn. Fl. 139.

On the Mohave River, *Palmer,* 1876, n. 401.

27. **G. setosissima,** Gray. Providence Mountains (*Cooper*), and through Arizona to Southern Utah. The species has been confused with *Navarretia Schottii,* Torr. (which is now removed to *Læselia,* as will be seen under that genus), but is distinguished by its cuneate-tridentate leaves attenuate to a long narrow petiole and rarely at all pinnatifid, the bristles often in twos or threes, the corolla-limb equally lobed with the short stamens inserted at the sinuses (or one a little below), and by the longer oblong capsule.

31ª. **G. lutescens,** Steud. Closely resembling *G. floccosa;* corolla bright sulphur-yellow, 3 lines long, the tube not exserted and lobes hardly over a line long:

anthers long-oblong: ovules solitary: capsule oval, 3-seeded. — Gray, Syn. Fl. ii. 495. *Hugelia lutea*, Benth.

Probably near Monterey (*Douglas*); back of San Simeon (*Palmer*); also collected by *Lemmon*, locality uncertain. Referred to under *G. floccosa* as a synonym.

42ª. **G. latiflora**, Gray. A foot high or less, paniculately branched, glabrous, the inflorescence sparingly glandular: leaves mostly radical, an inch long, linear-oblanceolate, simply pinnatifid with short triangular cuspidate lobes, the cauline small, mostly entire, with a broad clasping base: inflorescence nearly as in *G. tenuiflora*, but the panicle more diffuse and the corolla (7 to 11 lines long) more dilated above the shorter (scarcely exserted) tube. — Syn. Fl. ii. 147. *G. tenuiflora*, var. *latiflora*, Gray, Bot. Calif. i. 498.

San Diego and Los Angeles Counties, *Fremont*, *Wallace*, *Palmer*, 1876, n. 402.

Page 499. **4. POLEMONIUM.**

2. **P. humile**, Willd., var. **pulchellum**, Gray. Less pubescent than the typical arctic form, the leaflets often nearly glabrous: flowers smaller, the corolla-lobes only 2 or 3 lines long, violet or lavender blue or nearly white. — Syn. Fl. ii. 150.

The Californian and Rocky Mountain forms are all referred to this variety.

3ª. **P. carneum**, Gray, l. c. Rather stout, 1 or 2 feet high, diffusely branched, glabrous or slightly pubescent, not glandular: leaflets (5 to 15) distinct, ovate to oblong-lanceolate, often 1½ inches long: branches subumbellately 3–5-flowered: calyx deeply 5-cleft, the lobes ovate-oblong: corolla salmon or flesh-color, becoming purplish, 8 to 12 lines long, with round-obovate lobes: style and stamens shorter than the corolla: ovules 3 or 4 in each cell.

Mountain woods, Siskiyou County (*Greene*); Saucelito (*Kellogg*); Angel Island, *G. R. Vasey*.

Page 500. **5. LŒSELIA.** (By A. Gray.)

Two species, which have been more or less confused with *Gilia* (*Navarretia*) *setosissima*, have to be added to this genus, forming a section of it which connects it too closely with the Navarretias. They are depressed winter annuals, of small size, at length much branched; the leaves spinulose-setiferous and the upper subtending the flowers after the manner of several true Lœselias; the calyx-lobes tipped with a similar long white bristle: corolla purplish or violet, varying to white, the narrow tube little longer than the limb, two of the sinuses deeper and the two intermediate lobes rather shorter.

3. **L. Schottii**, Gray. An inch or two high; leaves linear or the upper cuneiform-spatulate, pinnatifid-toothed or the upper 3–5-lobed: lobes of the (white?) corolla oblong, acute: stamens moderately incurved above, shorter than the corolla-lobes; anther-cells oval-oblong. — *Navarretia Schottii*, Torr. Bot. Mex. Bound. 145. *Gilia Schottii*, Watson, Bot. King Exp. 267.

Mohave Desert (*Parry* & *Lemmon*), near the Colorado (*Coulter*, *Schott*), and S. Utah, *Palmer*.

4. **L. Matthewsii**, Gray. Rather larger: corolla (three-fourths of an inch long) purple and partly violet or sometimes white, strongly irregular; its lobes cuneate, truncate and more or less tridentate, surpassed by the more incurved filaments: anthers mostly larger, the cells oblong.

Camp Independence, Inyo County (*Dr. W. Matthews*); Mohave Desert, *Palmer*, *Lemmon*.

Page 502. Insert in Key to Genera, before *Nama*: —

10ª. **Lemmonia**. Corolla short-campanulate. Styles and subulate filaments short. Cells 2-seeded. Small depressed annual.

Page 504. **2. NEMOPHILA.**

4. **N. insignis,** Dougl. Pedicels much longer than usually in *N. Menziesii:* leaves occasionally few-lobed. — *N. modesta,* Kellogg, Proc. Calif. Acad. vii. 93.

Page 508. **5. PHACELIA.**

8ª. **P. hispida,** Gray. Distinguished from *P. ramosissima* by its annual root: inflorescence more open, the flowers on slender horizontal pedicels: calyx-lobes lax and elongated, nearly equalling the corolla, in fruit 4 to 6 lines long and 3 or 4 times longer than the capsule: seeds more oval. — Syn. Fl. ii. 161. *P. ramosissima,* var. *hispida,* Gray, Bot. Calif. i. 508.

San Diego to Santa Barbara; Butte County (*Mrs. Austin*); Arizona, *Palmer.*

12. **P. procera,** Gray. Siskiyou County, *Greene.*

13ª. **P. Mohavensis,** Gray. Diffusely branched or simple, about 4 inches high, glandular-hispid: leaves lanceolate to linear, an inch long or more, entire or rarely sparingly toothed, narrow at base: pedicels short, erect: calyx-lobes linear-spatulate: corolla purple, 3 or 4 lines long, little exceeding the calyx, the appendages long-oblong and adnate up to the truncate summit: filaments and style slightly exserted: ovules 4 or 5 to each placenta. — Syn. Fl. ii. 164.

On the Mohave River (*Palmer,* 1876, n. 387); Bear Valley, San Bernardino Mountains, *Parry & Lemmon.* The latter a slender erect form.

13ᵇ. **P. grisea,** Gray. Stouter, 6 to 8 inches high: leaves ovate, rather abruptly contracted to a short thick petiole, entire, an inch long: flowers nearly sessile, erect: calyx-lobes 2 or 3 lines long, variable, one or more broadly spatulate to ovate-spatulate, slightly exceeding the capsule: corolla 3 or 4 lines long; appendages as in the last: filaments and style much exserted: ovules 5 or 6 to each placenta. — Proc. Amer. Acad. xii. 80, and Syn. Fl. ii. 165.

On Pine Mountain, near San Simeon Bay, *Palmer,* 1876, n. 381.

17. **P. brachyloba,** Gray. San Diego, *Cleveland, Palmer.*

19. **P. Davidsonii,** Gray. San Bernardino County, *Parry & Lemmon,* n. 259.

26. **P. Ivesiana,** Torr. Surprise Valley, Modoc County, *Lemmon, Miss Plummer.*

27. **P. Fremontii,** Torr. — *P. Brannani,* Kellogg, Proc. Calif. Acad. vii. 90. Mohave Desert, *Mrs. A. E. Bush.*

28. **P. bicolor,** Torr. Surprise Valley, Modoc County, *Miss S. A. Plummer.*

28ª. **P. Cooperæ,** Gray. Somewhat hoary with a dense viscid pubescence: leaves oblong, obtuse, crenately subpinnatifid, ½ inch long, about twice longer than the petiole, the lowest larger and pinnately lobed: flowers sessile or nearly so, densely spicate; corolla tubular-funnelform, 4 to 6 lines long, 2 or 3 times longer than the calyx, the limb blue or violet, the narrow throat and tube yellow; appendages narrow, free from the filament: ovules 7 or 8. — Proc. Amer. Acad. xv. 49.

Santa Inez Mountains, Santa Barbara County, *Mrs. Elwood Cooper.*

35ª. **P. campanularia,** Gray. Resembling *P. Whitlavia;* about 6 inches high, rather stout: leaves subcordate, irregularly dentate, 1 to 1½ inches long, equalling the petiole: pedicels spreading, about equalling the calyx (3 to 5 lines long): corolla violet-purple, campanulate, 7 to 12 lines long; lobes spreading, about half as long as the tube; appendages glabrous: stamens scarcely exserted. — Syn. Fl. ii. 164.

Oriflamme Cañon, San Diego County (*Cleveland*); San Bernardino County, *Parry & Lemmon,* n. 263. *P. glandulosa,* Kellogg, Proc. Calif. Acad. vii. 92 (a preoccupied name), appears to belong to this section though likened to *P. ciliata.* The imperfect description leaves it uncertain whether it should be referred to *P. Parryi* or to *P. viscida.*

Page 516. **10. HESPEROCHIRON.**

1. **H. Californicus,** Watson. — *Nicotiana nana,* Lindl. Bot. Reg. t. 833. *Nierembergia nana,* Miers.

Page 517. **10ª. LEMMONIA,** Gray.

Corolla short-campanulate, not appendaged within. Filaments short, equally inserted, abruptly dilated at base. Styles 2, distinct to the base; stigmas small, capitate. Capsule membranaceous, ovoid, 2-celled and 2-valved, 4-seeded, the ovules and seeds 2 in each cell, one above the other. Seeds globular-obovate, somewhat rugose-pitted. — A small depressed dichotomously branched annual, with alternate entire leaves and whitish flowers sessile in the forks. — Proc. Amer. Acad. xii. 162, and Syn. Fl. ii. 153, 173.

1. **L. Californica,** Gray, l. c. Canescently pubescent and the calyx white-villous, the stout stems 2 or 3 inches long: leaves somewhat crowded at the ends of the branches, 3 or 4 lines long, spatulate, obtuse: sepals very narrowly linear, nearly 2 lines long, exceeding the obtuse capsule and nearly equalling the moderately 5-lobed corolla: seeds half a line long.

San Bernardino County, near the sources of the Mohave River, *J. G. Lemmon.*

11. NAMA, Linn.

5. **N. Rothrockii,** Gray. — Rothrock, Bot. Wheeler Exp. 369, t. 18.

Page 518. **12. ERIODYCTION.**

2. **E. glutinosum,** Benth. Plumas County, *Mrs. Austin.* This is sometimes known as Yerba Santa.

Page 519. Insert in Key to Genera: —

7ª. **Echidiocarya.** Flowers white. Nutlets distinctly stipitate, distinct or in pairs, inserted upon a broadly conical receptacle, incurved-ascending. Hirsute annuals.

Page 523. **5. MERTENSIA.**

1. **M. Sibirica,** Don. — *M. stomatechoides,* Kellogg, Proc. Calif. Acad. ii. 147, fig. 43.

Page 527. **7. ERITRICHIUM.**

8ª. **E. micranthum,** Torr. Hirsute-canescent, more slender and openly diffuse than *E. circumscissum,* 2 to 5 inches high: leaves linear, 2 to 4 lines long: flowers small, leafy-bracteate, nearly sessile: calyx 5-parted, persistent and not circumscissile, equalling the bracts, scarcely a line long: corolla white, a line long, throat scarcely appendaged: nutlets smooth or scabrous, oblong-ovate, acute, about ½ line long, attached the whole length by a narrow groove to the slender columnar receptacle: style becoming thickened. — Gray, Syn. Fl. ii. 193.

Var. **lepidum,** Gray, l. c. Less slender and more hirsute: corolla larger, the expanded limb 2 or 3 lines broad and appendages manifest: nutlets nearly a line long, scabrous.

San Bernardino County (*Parry*) to Utah and New Mexico; the variety in San Diego County, *D. Cleveland.* Intermediate between the sections *Piptocalyx* and *Krynitzkia,* which are united by Dr. Gray in the Synoptical Flora.

12ª. **E. barbigerum,** Gray. A foot high or less, rather stout, with linear-oblong leaves: spikes elongating, somewhat loosely flowered, subsecund: calyx-lobes linear-

attenuate, 3 or 4 lines long in fruit, very bristly: corolla-limb sometimes 3 lines broad: nutlet usually solitary, a line long or more, exceeding the style, ovate-triquetrous and subacuminate, muricate-papillose, attached by the lower half or more to the subulate-columnar receptacle. — Syn. Fl. ii. 194.

From Santa Barbara (*Brewer, Rothrock*) and Fort Tejon (*Xantus*) to San Diego (*Palmer*), and eastward to Arizona and Southern Utah.

Page 529. **8. ECHINOSPERMUM.**

§ 1. *Prickles of the fruit glochidiate-barbed at the apex, naked below, marginal or scattered.* — LAPPULA.

1. **E. Redowskii**, Lehm., var. **occidentale**, Watson. — Gray, Syn. Fl. ii. 189. The American plant differs from the Asiatic in its less strict and at length more diffuse habit, and the tubercles of the nutlets acute instead of blunt or rounded.

2. **E. diffusum**, Lehm. (Substitute for **E. deflexum**, in part.) Distinguished by the short-funnelform corolla, the tube exceeding the calyx and about equalling the lobes; limb 6 lines broad or less, bright blue: fruit a globose bur, the nutlets 3 lines long, densely muriculate-scabrous and rather sparsely armed with long flattened prickles; scar large, broadly ovate. — Gray, Syn. Fl. ii. 189. *E. nervosum*, Kellogg, Proc. Calif. Acad. ii. 146, fig. 42.

In the Sierra Nevada from Mount Brewer and vicinity to Mount Shasta and Oregon. Biennial or perhaps perennial, 1 to 3 feet high.

3. **E. floribundum**, Lehm. Perennial, 2 feet high or more: corolla rotate, its tube shorter than the calyx and the lobes, blue to nearly white, 2 to 5 lines broad: nutlets 2 lines long, scabrous on the back and margined with a close row of flat subulate prickles often confluent at base; scar smaller, narrowly ovate. — Gray, l. c.

Plumas County (*Mrs. Austin*); northward to the Columbia and frequent in the mountains eastward to Montana, Colorado and New Mexico.

§ 2. *Prickles of the marginless nutlets scattered and retrorsely barbed their whole length.* — ECHINOGLOCHIN, Gray.

4. **E. Greenei**, Gray. Annual, with the habit of *Eritrichium Californicum;* branches ascending, 6 inches long: flowers scattered, very shortly pedicelled, in simple or forked nearly naked racemes; pedicels jointed at base: calyx fulvous-hairy, the linear lobes 2 lines long, about equalling the white corolla: nutlets 1½ lines long, ovate-triangular, obtusely carinate on the back. — Proc. Amer. Acad. xii. 163, and Syn. Fl. ii. 190.

Common about Yreka, *E. L. Greene.*

Page 531. **9. CYNOGLOSSUM.**

3. **C. læve**, Gray. Very near *C. grande*, but somewhat less pubescent, the leaves rather broader and more cordate at base, and the calyx-lobes narrower; corolla-lobes about half the length of the tube; filiform style less thickened toward the base: fruit unknown. — Syn. Fl. ii. 188.

Plumas County (*Mrs. Ames*); above Chico, *Mrs. J. Bidwell.*

10. PECTOCARYA.

§ 1. *Nutlets divergent in pairs, bordered with a coriaceous undulate or laciniate wing.* — KTENOSPERMUM, Gray.

1. **P. linearis**, DC. Nutlets narrowly oblong; otherwise as *P. lateriflora*, DC., from Peru, which has broadly obovate and more equally divergent nutlets.

2. **P. penicillata**, A. DC. Arizona (*Palmer, Greene*); British Columbia, *Macoun.*

§ 2. *Nutlets broadly obovate and diverging equally, the wing or margin entire.* — GRUVELIA, Gray. (*Gruvelia*, A. DC.)

3. **P. setosa,** Gray. Rather stout, 3 or 4 inches high, hispid and minutely strigose-pubescent: calyx-lobes armed with 3 or 4 large divergent bristles: nutlets bordered by a broadish scarious wing, the face and margin beset with slender uncinate-tipped bristles. — Proc. Amer. Acad. xii. 81, and Syn. Fl. ii. 187.

In the Mohave Desert, *Palmer*, 1876, n. 379.

4. **P. pusilla,** Gray, l. c. More slender and spreading, less hispid: nutlets with a prominent midnerve upon the smooth face, the very narrow thickish margin armed with a row of slender uncinate-tipped bristles. — *Gruvelia pusilla*, A. DC. Prodr. x. 119; Gay, Fl. Chil. t. 52, fig. 3.

Common about Yreka (*Greene*); Chili.

11. HARPAGONELLA.

1. **H. Palmeri,** Gray. Near Tucson, Arizona, *Greene*.

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1ª. DICHONDRA, Forst.

Small prostrate creeping herbs, with round-cordate or reniform leaves, small solitary axillary flowers, a deeply 5-lobed campanulate corolla, the ovary of 2 distinct 1–2-ovuled carpels and 2 filiform styles with capitate stigmas, and the carpels in fruit utricular and 1-seeded.

A genus of perhaps 4 or 5 species of warm or tropical regions, the following very widely distributed.

1. **D. repens,** Forst. Slender, widely creeping, green or greenish, with a minute soft pubescence or sometimes silky: leaves orbicular-cordate or reniform with deep sinus, 4 to 12 lines in diameter, on long petioles: flowers on peduncles shorter than the petioles; sepals obovate to spatulate, obtuse, 1 to 2 lines long in fruit, rather exceeding the yellow corolla and equalling the subglobose pubescent carpels. — Gray, Syn. Fl. ii. 208.

San Diego (*Nuttall, Cleveland*); Arizona and Sonora, and eastward to the Atlantic. Also in South America, Africa and Australia.

1ᵇ. IPOMŒA, Linn. MORNING GLORY.

Stigma globular or stigmatic lobes orbicular; otherwise as *Convolvulus*.

A large genus, of 300 species or more, chiefly of warm and tropical regions. Twenty-five species are found in the Southern States and in the region bordering on Mexico, but the following Mexican species is the only one that has been detected within or near the limits of California.

1. **I. purpurea,** Lam. An annual climbing herb: leaves cordate, entire: peduncles elongated, umbellately 1–5-flowered: sepals lanceolate, ½ inch long, the thickened pedicels twice longer; corolla funnelform, about 2 inches long, variously purple, blue, and white: stamens and style not exserted: stigma-lobes 3, and ovary 3-celled. — Gray, Syn. Fl. ii. 209.

San Diego (*Cleveland*); perhaps indigenous. The common Morning Glory, native of Mexico.

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1. CONVOLVULUS.

6ª. **C. arvensis,** Linn. Perennial, the low stem procumbent or twining, nearly glabrous: leaves oblong-sagittate or somewhat hastate, 1 or 2 inches long, basal lobes short and acute: bracts a pair at the base of the pedicel, small, subulate: corolla broadly short-funnelform, an inch long or less, white or pinkish: stigmas filiform. — Gray, Syn. Fl. ii. 216.

Naturalized near San Francisco, *Rattan*. Native of Europe.

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3. CUSCUTA.

7. **C. racemosa**, Mart., var. **Chiliana**, Engelm. Stems coarse: flowers pedicelled, loosely paniculate; calyx shorter than the deeply campanulate somewhat funnelform tube of the corolla: lobes of the corolla shorter than the tube, oval, spreading or reflexed with inflexed points: ovary and capsule pointed, the latter enveloped by the withered corolla. — Rev. Cusc. 504, and Gray, Syn. Fl. ii. 221. *C. suaveolens*, Seringe; Gay, Fl. Chil. iv. 448.

Not rare in fields of Alfalfa, with the seeds of which it has been introduced from South America. Flowers 1½ or 2 lines long, of thin texture, white and conspicuous, in large loose clusters. Farmers should be careful to destroy this dangerous weed before it bears seed. — *Engelmann.*

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2. SOLANUM.

3. **S. Xanti**, Gray. Lake and Siskiyou Counties, *Greene.*

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5. PHYSALIS.

5. **P. Palmeri**, Gray. A foot high or less, from a perennial rootstock, erect, branching, viscid-pubescent with short jointed hairs: leaves ovate or deltoid-ovate, or the lowest rounded or subcordate, sinuate-dentate with a few obtuse teeth, 1 to 1½ inches long or smaller, the upper acute: pedicels mostly longer than the flower: corolla light yellow with brownish centre, 7 or 8 lines broad: anthers yellow: fruit not seen. — Syn. Fl. ii. 235.

Rock Spring, Providence Mountains, *Palmer.*

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7. LYCIUM.

1. **L. Cooperi**, Gray, var. **pubiflora**, Gray. Calyx shorter: corolla strongly pubescent outside. — Syn. Fl. ii. 238.

On the Mohave River, with the ordinary form, *Palmer.*

6. **L. Andersonii**, var. **Wrightii**, Gray. San Bernardino Mountains, *Parish.*

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8. DATURA.

2. **D. Tatula**, Linn. Reported from Siskiyou County, *Greene.*

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9. NICOTIANA.

3ª. **N. glauca**, Grah. Perennial, becoming a small tree, glabrous and glaucous: leaves long-petioled, ovate- to oblong-lanceolate, acute, at base cuneate or rounded or sometimes cordate, 3 to 5 inches long: panicles lax and slender: subulate bracts small or obsolete: calyx tubular-campanulate, 5-toothed, 5 lines long: corolla tubular, 1 to 1½ inches long, contracted below the very short limb, greenish-yellow. — Bot. Mag. t. 2837.

Los Angeles and Santa Barbara (*H. C. Ford*); formerly cultivated, now wild. Native of Buenos Ayres; naturalized in Mexico.

4. **N. attenuata**, Torr. Cañon City and hillsides along John Day River, Oregon, *Nevius.*

4ª. **N. Clevelandi**, Gray. Viscid-pubescent or somewhat villous, 1 or 2 feet high: leaves ovate or ovate-lanceolate, acute, 2 or 3 inches long, the lower somewhat attenuate into a margined petiole, the upper nearly sessile with a more rounded base; bracts lanceolate: flowers paniculate-racemose: calyx nearly ½ inch long, with linear unequal lobes, the longer twice the length of the tube: corolla greenish white, nearly glabrous, an inch long, salverform, the somewhat 5-lobed limb ½ inch in diameter. — Syn. Fl. ii. 242.

Chollas Valley, near San Diego, in dry stream-beds (*Cleveland, Palmer*); Santa Barbara, a smaller-flowered form, *Rothrock.*

5. **N. Bigelovii**, Watson, var. **Wallacei**, Gray, l. c. A more viscid form with smaller corolla (tube 12 to 16 lines long), and shorter calyx-teeth sometimes scarcely exceeding the capsule: upper leaves with somewhat broader and roundish or subcordate slightly clasping base.

Near Los Angeles (*Wallace*) and San Diego, *Cleveland*.

Page 547. Insert in Key to Genera: —

10ª. **Herpestis**. Calyx unequally 5-parted, the lower sepal the larger. Anther-cells parallel. Creeping succulent herb.

Page 548. **1. VERBASCUM.**

2. **V. Thapsus**, Linn. Densely woolly throughout: stem simple, stout, 3 to 6 feet high, winged by the decurrent bases of the large oblong nearly entire crowded leaves: flowers bright yellow, in a long dense spike: lower filaments nearly naked. — Gray, Syn. Fl. ii. 250.

Siskiyou County, *Greene*. Native of Europe, widely naturalized in old fields.

Page 551. **3. ANTIRRHINUM.**

15. **A. junceum**, Gray. Cerros Islands, *Dr. Streets*.

Page 555. **6. COLLINSIA.**

7ª. **C. linearis**, Gray. Allied to *C. grandiflora*, but puberulent and slightly glandular above; usually much branched, ½ to 2 feet high, glabrous: leaves linear to linear-spatulate, ½ to 3 inches long, entire or the lower sparingly toothed, sessile: pedicels 1 to 4 in the axils, about equalling the flowers: calyx-lobes triangular, acute: corolla pale blue, ½ inch long, strongly declinate and gibbose-saccate, lips longer than the tube and throat, the lower with a rather prominent sometimes 2-lobed callus: ovules 3 in each cell. — Proc. Amer. Acad. xv. 50.

On Klamath and Trinity Rivers, and at Waldo, Oregon (*Rattan*); Siskiyou Mountains, *Greene*.

8ª. **C. Parryi**, Gray. Puberulent, not glandular; stem strict, simple, a foot high or less: leaves narrowly oblong to linear-lanceolate, the lower petioled, the upper sessile, obtuse, sparingly crenate: pedicels (1 to 3) mostly solitary, slender, 2 to 8 lines long: calyx-lobes oblong, obtuse, not exceeding the capsule: corolla deep blue, 3 or 4 lines long, with moderately oblique throat, the nearly equal lips not longer than the tube, with emarginate lobes: ovules 6 or 7 in each cell: seeds round-oval, reticulated. — Syn. Fl. ii. 257.

San Bernardino County, *Parry & Lemmon*, n. 296.

10. **C. Childii**, Parry. Puberulent and somewhat glandular above, simple or branched, a foot high or less: leaves thinnish, the lower round-obovate or oblong, petioled, the upper oblong-lanceolate with narrow base, subsessile, acutish, more or less serrate: pedicels 1 to 3, half an inch long or less: calyx-lobes oblong-lanceolate, obtuse, exceeding the globose capsule: corolla light blue, 3 lines long, the oblong moderately oblique throat longer than the lips, the lobes of which are about equal and entire: ovules solitary: seed terete, oblong, smooth. — Syn. Fl. ii. 257.

In deep woods of *Libocedrus*, San Bernardino Mountain (*Parry & Lemmon*, n. 298, *H. S. Child*); Kern County, *Kennedy*.

11. **C. Rattani**, Gray. Slender, simple or sparingly branched, a foot high or less, puberulent, glandular above: lower leaves round-ovate to oblong, petiolate, somewhat serrate, the upper linear (6 to 14 lines long), sessile, mostly entire: pedicels 1 or 2, about 3 lines long: calyx-lobes broadly lanceolate, acutish, rather exceeding the oblong-ovate acute capsule: corolla reddish violet, 3 lines long, slightly declined, the lips about equalling the tube: ovules 1 or 2 in each cell: seeds lenticular, margined. — Proc. Amer. Acad. xv. 50.

Open ridges south of Trinity River (*Rattan*); Simcoe Mountains, Oregon, *Howell*.

Page 556. **7ª. CHELONE,** Linn. TURTLE-HEAD.

Seeds surrounded by a broad membranous wing. Otherwise nearly as *Pentstemon.* Anthers long-woolly (as in *P. Menziesii*), chiefly upon the inner face.

A North American genus, of three Atlantic species, and the following on the Pacific Coast.

1. **C. nemorosa,** Dougl. Glabrous, the inflorescence glandular-pubescent, a foot or two high: leaves ovate to ovate-lanceolate, acute and acutely dentate, truncate or subcordate at base, shortly petiolate or subsessile, 2 or 3 inches long: flowers pedicellate in a loose terminal panicle, the 2–5-flowered peduncles as long as the pedicels: sepals lanceolate, acuminate: corolla violet-purple, an inch long, with widely open orifice, the very short upper lip 2-cleft, the lower 3-cleft and spreading. — Lindl. Bot. Reg. t. 1211; Gray, Syn. Fl. ii. 259.

On Salmon Trail at head of Scott River (*Greene*); Oregon (*Newberry*); base of Mount Hood, *Howell.* Approaching *Pentstemon* more closely than the eastern species.

Page 556. **8. PENTSTEMON.**

1. **P. Menziesii,** Hook. Dwarf states of the more northern typical form, with violet-blue flowers, occur on Mount Shasta.

Var. **Newberryi,** Gray. — The common form in the Sierra Nevada, with rose-purple or pink corollas.

7ª. **P. Rothrockii,** Gray. Low (4 to 6 inches high), woody at base, minutely puberulent: leaves ovate-oblong, obtuse or acutish, subcordate or truncate at base, sessile or nearly so, entire or sparingly serrate, 3 to 5 lines long: flowers subspicate, subsessile and mostly solitary, bibracteolate and with small leafy mostly alternate bracts: sepals ovate-lanceolate, 1½ lines long: corolla 4 lines long, the rather narrow tube and throat longer than the lips, apparently purplish: sterile filament glabrous. — Syn. Fl. ii. 260.

Little Olanche Mountain, head of Kern River, at 10,400 feet altitude, *Rothrock.*

9. **P. Palmeri,** Gray. San Bernardino County (*Parry & Lemmon*); Kern County, *Kennedy.*

11ª. **P. Rattani,** Gray. Stem 1 to 3 feet high, simple or branching above, glabrous below, the thyrsoid inflorescence viscid-pubescent: leaves ovate-lanceolate to oblong, acutely denticulate, acute, the lower attenuate at base, the rest subcordate at base and clasping, 3 to 8 inches long: lower cymes peduncled, 5–8-flowered; pedicels very short: sepals lax, oblong-lanceolate, subacuminate: corolla pale purple, an inch long, the oblique throat dilated and the tube a little shorter than the calyx; lower lip bearded within: sterile filament bearded. — Proc. Amer. Acad. xv. 50.

Var. **minor,** Gray, l. c. Apparently a reduced form, with leaves an inch or two long and flowers a half smaller.

Humboldt Ridge, Humboldt County; the variety from Indian Creek, Del Norte County, *Rattan.*

14ª. **P. heterodoxus,** Gray. Hardly 6 inches high, leafy, glabrous below the viscid-pubescent inflorescence: leaves oval or oblong, obtuse or acute, the lower attenuate to a slender petiole, the cauline sessile, 1 or 2 inches long: panicle narrow, compact: sepals lanceolate: corolla narrowly tubular, hardly dilated above, 7 lines long: fifth filament beardless, sometimes antheriferous. — Syn. Fl. ii. 269.

Near Donner Pass, *Torrey.* Referred to *P. Fremonti* on page 622, which species is not known from California.

17. **P. Eatoni,** Gray. This species is only known from Utah and Arizona. The specimens collected by *Wallace* belong to *P. Clevelandi.*

21. **P. azureus,** Benth., var. **parvulus,** Gray. Less than a foot high: leaves oblong and oval, an inch long or less: inflorescence rather open: sepals broadly ovate: corolla hardly 9 lines long. — Syn. Fl. ii. 272.

Var. **angustissimus**, Gray, l. c. Leaves narrowly linear or sometimes the uppermost narrowly lanceolate from a broad base.

The first variety above Jackson Lake, Siskiyou Mountains (*Greene*); the extreme narrow-leaved form from Yosemite Valley, etc.

Page 565. **9. MIMULUS.**

11. **M. glutinosus**, var. **brachypus**, Gray. Butte County, *Mrs. Austin.*

18. **M. bicolor**, Benth. — *M. Eisenii*, Kellogg, Proc. Calif. Acad. vii. 89.

18ª. **M. Palmeri**, Gray. Viscid, but scarcely pubescent: leaves lanceolate or the lower spatulate, mostly entire, about ½ inch long, shorter than the filiform pedicels: corolla crimson, dilated funnelform, about 9 lines long, thrice the length of the calyx, the lobes nearly equal and equally spreading: fruiting calyx narrowly oblong, 3 or 4 lines long, the teeth broad and obtuse. — Proc. Amer. Acad. xii. 82, and Syn. Fl. ii. 278.

21. **M. moschatus**, Dougl., var. **longiflorus**, Gray. Corolla elongated, thrice longer than the calyx, about an inch long: later pedicels exceeding the leaves. — Syn. Fl. ii. 278.

The usual form in California, also in Oregon.

Page 570. **10ª. HERPESTIS**, Gaertn. f.

Calyx unequally 5-parted, the lower sepal broader than the upper and the lateral ones usually much narrower and interior. Corolla with short cylindrical tube and spreading lips, the upper emarginate or 2-lobed, the lower flat, 3-lobed. Stamens 4, included; anther-cells parallel or divergent. Stigma of 2 flat lobes (in our species). Capsule globose or ovate, many-seeded, the entire or 2-parted valves separating from the axile placentæ. — Low usually glabrous herbs, with opposite leaves and axillary mostly solitary pedicellate flowers.

About 50 species are known, chiefly of warm countries, of which but half a dozen are found in the United States, and hardly one enters California.

1. **H. rotundifolia**, Pursh. Perennial, on the margins of ponds, etc., the stems creeping, rather stout and succulent, usually somewhat villous: leaves obovate or oblong-obovate, sessile, entire, ¼ to 1 inch long, several-nerved from the base: pedicels 1 to 3, at length spreading or reflexed, 3 to 6 lines long: corolla white or yellowish, 4 or 5 lines long, twice longer than the oblong-ovate sepals, the broad upper lip emarginate and as long as the tube: capsule 4-valved. — Gaertn. f. Carp. t. 214 (fruit); Gray, Syn. Fl. ii. 280. *Ranapalus Eisenii*, Kellogg, Proc. Calif. Acad. vii. 113.

Between San Luis Obispo and Merced (*Lemmon*); near Fresno (*Dr. G. Eisen*); New Mexico (*Wright*); Kansas, and eastward.

Page 571. **14. SYNTHYRIS.**

1. **S. reniformis**, Benth. Scape exceeding the leaves, erect: pedicels mostly shorter than the bluish flowers: capsule flattened, rounded, truncate or usually emarginate; ovules and usually seeds several or numerous in each cell. — Gray, Syn. Fl. ii. 285.

Camp Bidwell, Modoc County (*Dr. W. Matthews*); northward through Oregon to Idaho and Washington Territory. The specimens referred to it in the first volume belong to the following.

2. **S. rotundifolia**, Gray, l. c. Scapes weak, hardly exceeding the petioles: raceme short, lax, the pedicels longer than the flowers: capsule divaricately 2-lobed, the cells transversely oblong; ovules and seeds two in each cell.

Var. **cordata**, Gray. Leaves smaller and thicker, cordate or mostly cordate-ovate, and simply crenate. — *S. reniformis*, var. *cordata*, Gray, Bot. Calif. i. 571.

The typical form in Oregon and Washington Territory; the variety in Mendocino County.

Page 572. **15. VERONICA.**

1ª. **V. scutellata**, Linn. Plumas County (*Mrs. Austin*); Yosemite Valley, *Lemmon*.

2ª. **V. Cusickii**, Gray. Resembling *V. alpina*, about 4 inches high: leaves rather crowded, entire: raceme loosely few-flowered, naked below; pedicels slender, often as long as the flower, exceeding the oblong-linear bracts: corolla 4 or 5 lines broad with ample rounded lobes: filaments and style filiform, exserted. — Syn. Fl. ii. 288.

Scott Mountains (*Greene*); Blue Mountains, Oregon, *W. C. Cusick*.

3. **V. serpyllifolia**, Linn. Plumas County, *Mrs. Austin*.

Page 573. **16. CASTILLEIA.**

2ª. **C. stenantha**, Gray. Resembling *C. minor*, 1 to 5 feet high, somewhat villous: calyx equally cleft: corolla linear, 1 to 1½ inches long, the slightly falcate and usually reddish upper lip one-half longer than the tube. — Syn. Fl. ii. 295.

Common in Southern California, from San Diego to Monterey and in the southern Sierra Nevada. *C. affinis*, Hook. & Arn., with which this species was confused, is a perennial, the red narrowly cylindrical calyx cleft more deeply below, the lobes bifid, and the lower lip of the corolla protuberant and shortly callous.

3ª. **C. oblongifolia**, Gray, l. c. Resembling *C. affinis* and *C. linariæfolia* in calyx and corolla, but more densely pubescent and very leafy, the leaves oblong-elliptic or oblong-ovate, acute, 3–5-nerved, 1 or 2 inches long, on the branches becoming narrowly oblong-lanceolate: calyx-lobes narrowly lanceolate or linear: corolla 2 inches long, the subfalcate narrow upper lip as long as the tube, the lower very protuberant and fleshy globular-saccate.

Southern border of San Diego County, *Palmer*. Collected with *C. miniata*.

8ª. **C. Lemmoni**, Gray, l. c. 297. Closely resembling *C. pallida*, var. *occidentalis*: bracts reddish: upper lip of the corolla oblong, about a fourth the length of the tube, hardly twice that of the ventricose lower lip, the ovate lobes of the latter rather shorter than the saccate portion, the three narrow obtuse folds of which terminate under the lobes in as many conical gibbosities.

In the Sierra Nevada, Sierra County, probably alpine, *J. G. Lemmon*.

Page 577. **17. ORTHOCARPUS.**

5. **O. purpurascens**, Benth. Santa Barbara (*Mrs. Cooper*); San Diego, *Cleveland*.

7ª. **O. pachystachyus**, Gray. Resembling *O. tenuifolius*, rather stout, 4 to 8 inches high, scabrous-puberulent and somewhat hirsute: bracts twice longer (about an inch), rose-purple at the summit: corolla glabrous, the tube much longer than the calyx, the tip of upper lip conspicuous, slender and incurved: anther-cells glabrous, linear-lunate, mucronate-attenuate at base. — Syn. Fl. ii. 300.

Near Yreka, Siskiyou County (*Greene*); Union, Oregon, *W. C. Cusick*.

12ª. **O. Bidwelliæ**, Gray. With the aspect of *O. erianthus*, somewhat less pubescent and the spike rather loose: corolla 6 to 10 lines long, the throat and upper lip dark purple, the trisaccate lower lip bright yellow: seed-coat somewhat loose and cellular. — Proc. Amer. Acad. xv. 51.

Near Chico (*Mrs. J. Bidwell*); Auburn, *Mrs. M. E. P. Ames*.

17ª. **O. lasiorhynchus,** Gray. Resembling *O. lacerus;* more usually branched: corolla yellow, an inch long, with filiform tube, the lower more dilated; lower lip 3 or 4 lines long and the subulate-linear upper lip densely white-villous. — Proc. Amer. Acad. xii. 82, and Syn. Fl. ii. 302.

Mohave region (*Palmer*); San Bernardino County, *Parry* & *Lemmon*.

Page 583. **19. PEDICULARIS.**

5. **P. semibarbata,** Gray. San Bernardino Mountains, *Parry* & *Lemmon*.

Page 585. **1. APHYLLON.**

6. **A. tuberosum,** Gray. San Bernardino County (*Parry*); San Diego, *Palmer*.

2. BOSCHNIAKIA.

1. **B. strobilacea,** Gray. Seeds deeply favose. — San Bernardino County (*Lemmon*); on the Trinity River, common, *Rattan*.

Page 586. **1. UTRICULARIA.**

3. **U. intermedia,** Hayne. Leaves crowded, 2-ranked, repeatedly dichotomous, rigid, the filiform-linear divisions flat with often setaceous-serrulate margins: bladders mostly borne along leafless portions of the slender stems: scapes slender, 4 to 12 inches high, 1 – 4-flowered: pedicels erect in fruit: corolla yellow, over 6 lines broad; lower lip very broad and with large palate, larger than the upper and somewhat exceeding the conical-subulate acute spur. — Reichenb. Icon. Fl. Germ. t. 1824; Engl. Bot. t. 2489.

Plumas County (*Mrs. Austin*); from the northern Atlantic States northward, and through northern Europe and Asia.

Page 590. Insert in Key to Genera: —

7ª. **Acanthomintha.** Flowers several and sessile in each axil, subverticillate and involucrate with large foliaceous bracts. Upper lip of corolla concave and incurved.

19. **Teucrium.** Corolla-limb irregular, deeply cleft between the small lobes of the upper lip, the stamens exserted from the cleft: middle lobe of lower lip much the larger.

Page 593. **5. MONARDELLA.**

1. **M. macrantha,** Gray. Corolla sometimes all scarlet in cultivation. — Hook. f. Bot. Mag. t. 6270.

3ª. **M. hypoleuca,** Gray. Pubescent, 1 or 2 feet high: leaves densely tomentose-canescent beneath, silvery-white when young, glabrate and green above, ovate-oblong, obtuse, entire, 1 or 2 inches long, distinctly petioled; veins conspicuous, impressed above: heads large; bracts orbicular to ovate, nerved, obtuse and pointless. — Syn. Fl. ii. 356.

San Bernardino County, *Parry* & *Lemmon*.

5. **M. linoides,** Gray. Head of Mohave River, *Parry* & *Lemmon*.

5ª. **M. Palmeri,** Gray, l. c. 357. Resembling *M. linoides*, glabrous and green, or obscurely puberulent, 3 or 4 inches high: bracts oblong or the outer ovate, obtuse or acutish: calyx more purple, less pubescent, with longer linear-lanceolate teeth.

Among redwoods in the Santa Lucia Mountains, *Palmer*.

8. **M. candicans,** Benth., var. **exilis,** Gray. Smaller; bracts mostly with a short scarious acumination: calyx-teeth acute. — Syn. Fl. ii. 358.

Southeastern California or Western Arizona, *Palmer*.

11. **M. leucocephala,** Gray. On the Merced, *Mrs. A. E. Bush*. Corolla pure white, the tube slightly exserted.

Page 596. **7ª. ACANTHOMINTHA,** Gray.

Separated from *Calamintha*, and the other genera of the tribe, by the concave and more or less incurved upper lip of the corolla. Calyx 13-nerved, bilabiate, the teeth acerose-spinulose. Lower stamens much shorter, with small or abortive anthers. — Syn. Fl. ii. 344. *Calamintha* § *Acanthomintha*, Gray, Proc. Amer. Acad. viii. 368.

1. **A. ilicifolia,** Gray. — Syn. Fl. ii. 365. *Calamintha* (?) *ilicifolia*, Gray.

Page 598. **9. SPHACELE.**

1. **S. calycina,** Benth. Butte County, *Mrs. J. Bidwell*, *Mrs. Austin.*

Page 601. **11. AUDIBERTIA.**

9. **A. polystachya,** Benth. Known as "White Sage" in the bee-pastures of Southern California.

Page 603. **13. SCUTELLARIA.**

2ª. **S. Californica,** Gray. Puberulent, 8 to 20 inches high, slender: leaves from oblong-lanceolate to ovate, mostly roundish at base, short-petioled, the lower an inch long or more, often somewhat serrate, gradually reduced upward, and above shorter than the flowers: corolla yellow or whitish, with inflated throat and nearly equal lips, villous within: seeds obscurely rugose-granulate. — Syn. Fl. ii. 381. *S. antirrhinoides*, var. *Californica*, Gray, Proc. Amer. Acad. viii. 396, and Bot. Calif. i. 603. *S. angustifolia*, Benth. Pl. Hartw. 333 (n. 1918).

From about San Francisco to Mendocino and Tehama Counties and in the foothills of the Sierra Nevada. Narrow-leaved forms resemble *S. antirrhinoides*, while the broader are more like *S. Bolanderi*.

Page 604. **15. BRUNELLA.**

1. **B. vulgaris,** Linn. In Humboldt County, very common, *Rattan.*

Page 607. **18. TRICHOSTEMA.**

1ª. **T. micranthum,** Gray. Annual, branching, about 6 inches high, hoary-pubescent: leaves narrowly lanceolate, not evidently nerved, narrowed to short petioles: peduncles about the length of the 3–7-flowered cymelet: calyx-lobes little longer than the tube, nearly equalling the inconspicuous purplish corolla (a line long): stamens somewhat exserted. — Syn. Fl. ii. 348.

Bear Valley, San Bernardino Mountains, *Parry & Lemmon*, n. 340.

4. **T. lanatum,** Benth. Popularly known as "Black Sage."

19. TEUCRIUM, Linn. GERMANDER.

Calyx 5-toothed or -parted, 10-nerved. Corolla seemingly 1-lipped, deeply cleft between the small lobes of the upper lip, which are united one on each side to the lateral lobes of the declined lower lip; middle lobe much the larger. Stamens 4, exserted from the cleft; anthers confluently 1-celled. Nutlets obovoid, with broad introrse scar.

A genus of about 100 species, widely distributed, but most abundant in the Mediterranean region. Only four species are known in the United States.

* *Erect, with undivided leaves, flowers in naked racemes, and a 5-toothed calyx.*

1. **T. occidentale,** Gray. Perennial, loosely pubescent, branched, 1 or 2 feet high: leaves ovate-oblong to broadly lanceolate, sharply serrate, 1 or 2 inches long:

calyx villous with viscid hairs, campanulate, the upper lobes acute or the middle acuminate, the lower triangular-subulate: corolla whitish or purplish, 4 or 5 lines long. — Syn. Fl. ii. 349.

On the Sacramento (*Pickering*); Arizona (*Palmer*); and eastward to New Mexico and Nebraska. The eastern *T. Canadense*, Linn., is less branched and somewhat tomentose, the flowers rather larger, and the canescent calyx with the upper teeth obtuse.

* * *Low and diffuse: leaves incisely cleft, with solitary axillary flowers: calyx 5-parted.*

2. **T. Cubense**, Linn. Annual, glabrous or nearly so, about a foot high: leaves cuneate-obovate or rhomboidal, short-petioled, crenately incised or 3–5-cleft to the middle, the upper sessile and palmately 3-cleft or 3–5-toothed, exceeding the flowers: calyx-lobes subulate-lanceolate, equal: corolla hardly exserted, pale blue or white, 3 or 4 lines long: nutlets somewhat corky, obscurely few-ribbed and punctulate. — Jacq. Stirp. t. 183, and Obs. t. 30; Gray, l. c.

Southeastern California or Western Arizona (*Palmer*), and eastward to Texas; also in Mexico and the West Indies and southward to Buenos Ayres. The similar *T. laciniatum*, Torr., is perennial, with larger exserted corolla 6 to 10 lines long.

Page 608. **1. VERBENA.**

2. **V. officinalis**, Linn. Very common about San Diego, *Cleveland*, *Palmer*.

4. **V. hastata**, Linn. Humboldt County, *Rattan*.

7. **V. ciliata**, Benth. Flowers sometimes white.

Page 611. **1. PLANTAGO.**

1. **P. major**, Linn., var. **Asiatica**, Decaisne. Capsule globose-ovoid, circumscissile near the base and much within the calyx. — Gray, Syn. Fl. ii. 389. *P. Asiatica*, Linn.

On the coast near San Francisco and northward to British Columbia and the Arctic Sea. The typical form of the species has the ovoid capsule dividing near the middle on a line with the top of the calyx; it may also occur as an introduced plant.

2ª. **P. eriopoda**, Torr. Crown with a dense mass of brownish wool: leaves oblanceolate to oval-obovate, 3 to 5 inches long, mostly glabrous: scape pubescent or glabrate a foot high or less; spike dense, cylindric: bracts round-ovate, scarious-margined: sepals scarious with greenish midrib: capsule ovoid, slightly exceeding the calyx: cells 1–2-seeded. — Gray, l. c.

On Shasta River and Hamilton Pass (*Greene*); Mad River (*Rattan*); eastward to Colorado and Wyoming and north to British America.

4. **P. Patagonica**, Jacq., var. **nuda**, Gray. Pubescence loose and scattered: leaves rigid, green and soon glabrate: bracts short. — Syn. Fl. ii. 391.

A not rare form; Santa Catalina Island (*J. Schumacher*); used in making "pinole," a kind of soup.

5. **P. hirtella**, HBK. (Substitute for **P. Virginica**, var.) Perennial: scape hirsute: flowers 3 lines long, the corolla-lobes ovate, acute. — Gray, l. c. 392.

Also in Mexico and Chili. *P. Virginica* is not found in California, though forms of it reach Texas and Southern Arizona.

Page 44. Insert the following new genus of *Cruciferæ*: —

20ª. STANFORDIA.

Pod linear, somewhat laterally compressed; valves thin-membranous, concave, carinately 1-nerved. Seeds in 2 rows, small, wingless: cotyledons incumbent, 3-parted. Sepals concave and carinate, more or less colored, unequal, the lateral somewhat broadly gibbous-saccate. Petals included, without claws, ovate at base, narrower toward the rounded summit, strongly undulate. Anthers straight, linear-oblong. Style short, with broad divergently 2-lobed stigma. — Annual, erect and branching, nearly glabrous, with toothed leaves.

1. **S. Californica.** About a foot high, sparingly pubescent at base with short simple spreading hairs: lower leaves oblanceolate with dilated petiole, obtuse, crenately toothed, 2 inches long, the upper lanceolate, sessile and clasping, acutely serrate: flowers in a loose raceme, on hairy pedicels 2 or 3 lines long, deep purple becoming pale: calyx 3 or 4 lines long: petals obpanduriform, somewhat cordate at base, equalling the sepals: stamens included: pods an inch long or less: seeds roundish, about half a line long; middle lobe of the cotyledons the larger.

Found near Tulare, *Mrs. A. E. Bush.* A very remarkable genus, allied to *Tropidocarpum*, to the Chilian *Schizopetalon*, and in some respects to *Greggia*, but peculiar in its calyx, corolla, and in the division of its cotyledons. It is named in honor of Leland Stanford, Esq., a prominent Californian, and patron of the "Botany of California."

ADDITIONS AND CORRECTIONS

TO VOL. II.

Page 2. **1. MIRABILIS.**

1. **M. multiflora,** Gray. Root very large: flowers open from four o'clock in the afternoon till nine in the morning.

3. **M. Californica,** Gray. This species is referred by Bentham & Hooker (Gen. Pl. iii. 4) to *Oxybaphus*, distinguishing that genus by a short campanulate or funnel-form perianth, and the involucre enlarged and veined in fruit.

Page 8. **2. RUMEX.**

2. **R. hymenosepalus,** Torr. Stem scarlet, 2 or 3 feet high, from a fascicled cluster of large tuberous roots. — *R. Saxei*, Kellogg, Pacif. Rural Press, June, 1879.

Banks of the Santa Anna River, near Anaheim (*A. W. Saxe*); near Los Angeles, in both dry and damp localities, *Mrs. A. E. Bush.* The stems and leaves have a pleasant acidity and are used in California, as in Utah, under the name of Wild Pie-plant. The roots are said to be gathered in Texas for tanning purposes, and the plant is known there as "Canaigre."

Page 10. **3. POLYGONUM.**

In character of section *Aviculuria* read: — *styles* 3, *deciduous.*

12ª. **P. Bidwelliæ,** Watson. Smaller, with short dense spikes, the large conspicuous 2-lobed scarious and chaff-like stipules (2 lines long) equalling or exceeding the bracts, entire or slightly lacerate-toothed at the summit: flowers somewhat

smaller: akene oblong-ovate, less than a line long including the very divergent styles. — Proc. Amer. Acad. xiv. 294.

Near Chico, *Mrs. John Bidwell*, May, 1878.

12ᵇ. **P. Greenei**, Watson, l. c. Resembling *P. Californicum*, with denser and stouter spikes, the bracts and finely fimbriate stipules 2 lines long: akene oblong-ovate, with very short and stout nearly erect styles.

Plains of Shasta (*Rev. E. L. Greene*, 1876); near Chico, *Mrs. J. Bidwell*, July, 1878.

14. **P. amphibium**, Linn. On Russian River (*V. Rattan*); head of King River, Inyo County, *Matthews*.

16ᵃ. **P. Persicaria**, Linn. Near Humboldt Bay, *Rattan*.

17. **P. acre**, HBK. At Los Angeles, *James*.

18. **P. Bistorta**, Linn. Near Humboldt Bay, *Rattan*.

Page 17. **5. ERIOGONUM.**

Insert in Key to Species: —

Pedicels erect or spreading: outer segments much broader above.
Leaves round-ovate: involucre puberulent. 21. E. THURBERI.
Leaves oblong-oblanceolate: involucre glabrous. 21ᵃ. E. PANDURATUM.

Insert after 24. E. THOMASII: —

Bracts and involucres glabrous: leaves narrowly oblanceolate: segments linear-oblong. 24ᵃ. E. GRACILLIMUM.

Insert after 30. E. KENNEDYI: —

Low, cespitose: leaves long, oblanceolate: bracts none: flowers yellow. 30ᵃ. E. OCHROLEUCUM.

7. **E. compositum**, Dougl. Klamath County, *Rattan*.

10. **E. ursinum**, Watson. Butte County, *Mrs. J. Bidwell*.

14. **E. spergulinum**, Gray. Inyo County, *Matthews*.

15. **E. hirtiflorum**, Gray. Sandhills of San Joaquin County, *Lemmon*.

21ᵃ. **E. panduratum.** Very slender, branching from the base, sparingly floccose-tomentose, glabrous above or the pedicels often very minutely glandular: leaves thin, tomentose, oblong-oblanceolate, attenuate into a long petiole, the blade ½ to nearly 1 inch long: bracts short, green and herbaceous: pedicels ascending, 2 to 8 lines long: involucres glabrous, turbinate-campanulate, nearly a line long: flowers white or pinkish, half a line long; outer segments with a reniform terminal lobe and narrow base, the inner narrowly oblong, undulate.

Collected by *J. G. Lemmon*; the locality uncertain.

24ᵃ. **E. gracillimum.** Low and very slender, reddish, floccose-tomentose below, glabrous above, the short stem sparingly leafy: leaves very narrowly oblanceolate, ½ inch long including the slender petiole; bracts herbaceous, linear-spatulate, the upper ones short: pedicels very slender, subsecund, divaricate, ½ inch long or less: involucre turbinate, glabrous, nearly a line long: flowers yellowish rose-color, very small; segments nearly equal, linear-oblong, pubescent.

Mohave Desert, Kern County, *Mrs. A. E. Bush*, June, 1879.

25. **E. trichopodum**, Torrey. Los Angeles, *Nevin*.

30ᵃ. **E. ochrocephalum.** Low, with much branched caudex, densely white-tomentose, the short stems very leafy: leaves oblanceolate, attenuate into a long slender petiole, the whole 1½ to 2 inches long: peduncles 4 or 5 inches tall: involucres capitate, crowded, without bracts or nearly so, turbinate-campanulate, slightly tomentose, 1½ or 2 lines long: flowers yellow, glabrous, small (a line long).

Valleys of Northwestern Nevada (Washoe or Roop County), *J. G. Lemmon*.

35. **E. parvifolium,** Smith. Los Angeles, *Mrs. A. E. Bush.*

36. **E. fasciculatum,** Benth. So common in some portions of Southern California as to be known as "Bee-feed" or "Wild Buckwheat."

Page 33. **7. CHORIZANTHE.**

Bentham & Hooker (Gen. Pl. iii. 93) still retain the genus *Centrostegia* as distinct from *Chorizanthe*, characterizing it by the 2–4-flowered 3–6-toothed divaricately spurred involucre, typical *Chorizanthe* having a 6-toothed spurless involucre and flowers always solitary. Both sections *Mucronea* and *Acanthogonum*, however, as recognized by them, deviate as much or more in the number of involucral teeth. A Chilian species of true Chorizanthe (*C. commissuralis*, Gay), represented in herb. Gray by specimens from Gay, has the involucre conspicuously and nearly or quite constantly spurred at base with divaricate spines, and a gibbous dilation at base is not rare in our own species. The only remaining character is invalidated by the fact that of the two species of *Chorizanthe* only one has with apparent uniformity more than one flower (2 or 3), while the other has rarely more than one. Considering the accepted heterogeneous character of the genus *Chorizanthe* it seems more reasonable and satisfactory to unite *Centrostegia* also with it, than to rest it upon characters none of which are constantly distinctive.

Insert in Key to Species, after 17. C. PARRYI: —

Leaves narrowly oblanceolate, not tomentose: awns of involucre straight: corolla-lobes nearly equal, broadly oblong. 17ª. C. FERNANDINA.

Like n. 20: bracts long-spinose: awns of involucre straight: corolla white, lobes round-obovate, unequal. 20ª. C. SPINOSA.

6. **C. stellulata,** Benth. Hillsides, Butte County, *Mrs. Austin.*

8. **C. diffusa,** Benth. San Luis Obispo (*Lemmon*); Santa Barbara, *Mrs. E. Cooper.*

10. **C. pungens,** Benth. Near San Bernardino, *Lemmon.*

17ª. **C. Fernandina.** Procumbent, rather stout, slightly silky pubescent: leaves narrowly oblanceolate, not tomentose: lower bracts foliaceous, the upper narrowly linear: tube of involucre a line long, the rather stout teeth with straight awns: flowers white, a line long; lobes nearly equal, broadly oblong, the alternate ones slightly narrower.

San Fernandino Cañon, Los Angeles County, *Mrs. A. E. Bush.* This species and *C. spinosa* differ from the rest of the subsection in the straight awns of the involucre.

18. **C. Xanti,** Watson. Near Crafton, Southern California, *Lemmon.*

20ª. **C. spinosa.** Resembling *C. uniaristata:* bracts more rigid, lanceolate, attenuate to a long spine: involucral segments unequal, one or two often much the larger, all with straight spines: flowers white; lobes round-obovate, entire, the alternate ones a half smaller.

Near San Bernardino, *Lemmon.*

21. **C. brevicornu,** Torr. Camp Independence, Inyo County, *Matthews.*

25. **C. Watsoni,** Torr. & Gray. Camp Independence (*Matthews*); Union County, Oregon, *W. C. Cusick.*

Page 39. **9. HOLLISTERIA,** Watson.

Involucre unilateral, of 3 equal slightly united herbaceous linear blunt bracts, 2-flowered, solitary and sessile in the axils. Perianth turbinate, membranous, 6-cleft to the middle. Stamens 9, on the throat, included. Styles slender. Akene glabrous, ovate, triangular above. Embryo curved, the orbicular cotyledons accumbent to the slender radicle. — A small fragile diffusely branched leafy annual, white-woolly throughout; leaves all foliaceous, cuspidate, apparently alternate with a very

small stipule-like pair at base; flowers unequally pedicelled, with a minute scarious bractlet at base. A single species. — Proc. Amer. Acad. xiv. 296.

1. **H. lanata,** Watson, l. c. Decumbent or prostrate, covered with loose woolly tomentum, less dense on the lower leaves: leaves oblanceolate, attenuate at base, the lower 1 to 3 inches long, the upper much shorter and narrowly ovate, aculeate-tipped, the stipule-like pair linear-subulate, 1 to 3 lines long: perianth woolly, a line long, the linear-lanceolate lobes green with a scarious margin, the inner slightly shorter and broader.

Near San Luis Obispo, *J. G. Lemmon.*

Page 46. **3. TELOXYS.**

This genus is referred by Bentham & Hooker (Gen. Pl. iii. 51) to section *Botryois* of *Chenopodium.* The species differ from others of that section only in the less pubescence and less divided leaves. Indeed *T. Mandoni,* Watson (Proc. Amer. Acad. ix. 91), is only *Chenopodium fœtidum,* Schrad.

Page 47. **4. CHENOPODIUM.**

6ª. **C. cornutum,** Benth. & Hook. l. c. — *Teloxys cornuta,* Torr.

Page 51. **7. ATRIPLEX.**

1. **A. patula,** Linn., var. **hastata,** Gray. Santa Barbara, *Mrs. E. Cooper.*

7. **A. bracteosa,** Watson. Near Los Angeles, *Nevin.*

8. **A. Coulteri,** Dietr. A decumbent perennial, with slender stems and leafy branches, the thin lanceolate sharply acuminate leaves 3 to 6 lines long, the fruiting bracts a line broad or more, with herbaceous laciniately toothed margin.

San Diego, near the shore, *D. Cleveland.* Mentioned under *A. microcarpa* and almost certainly to be referred to this species, which should accordingly be removed to the perennial group, following *A. polycarpa.*

15. **A. Californica,** Moq. Leaves often fleshy. Mohave Desert, *Mrs. Bush.*

19. **A. confertifolia,** Watson. Mohave Desert, *Mrs. A. E. Bush.*

Page 58. **12. SPIROSTACHYS.**

1. **S. occidentalis,** Watson. Tulare Plains, *Lemmon.*

Page 66. The Order **Buxaceæ** is reduced by Bentham & Hooker (Gen. Pl. iii. 239) to the rank of a Tribe in the order *Euphorbiaceæ.*

Page 70. **3. ARGYTHAMNIA.**

2. **A. sericophylla,** Gray. A matted bush, a foot high. Desert near Aqua Caliente, San Bernardino County, *S. B. Parish.* Flowering in January.

Page 73. **7. EUPHORBIA.**

1ª. **E. platysperma,** Engelm. Ms. "A prostrate glabrous annual, stems ½ to 1 foot long: leaves oblong-obovate, entire, short-cuspidate, thin and transparently reticulate, ½ inch long; stipules subulate, mostly entire: involucres large, hemispherical, solitary, with 1 to 4 naked or somewhat margin-appendaged glands: ovary oblong; the bifid styles very short: capsule large, oblong, 1¾ lines long, the carpels rounded on the back: seeds large (1½ lines long), flat, slightly convex on the back and carinate on the ventral side, reddish gray.

"Mouth of the Colorado River, *Palmer*, 1869. A well-marked species, allied to *E. occllata*, which likewise has the number of glands and their greenish appendages variable and uncertain, but distinguished from this and all others of the section by the large oblong capsule and the large flat seeds. Stamens very numerous, 15 to 20."

6. **E. serpyllifolia,** Pers. Near Santa Barbara, *Mrs. Elwood Cooper.*

Page 76. **1. CALLITRICHE.**

1. **C. marginata,** Torr. Near Santa Barbara, *Mrs. E. Cooper.*

Page 78. **1. ANEMOPSIS.**

1. **A. Californica,** Hook. — *Houttuynia Californica,* Benth. & Hook., Gen. Pl. iii. 128.

Page 80. **2. ALNUS.**

1. **A. rubra,** Bong. Santa Inez Mountains, *Mrs. E. Cooper.*

3. **A. oblongifolia,** Torr. San Bernardino Mountains, *Parry & Lemmon.* Described as reaching 80 feet in height and 2 or 3 feet in diameter. The leaves are sometimes 6 inches long, and the staminate and fruiting aments a half longer than stated.

Page 89. **1. SALIX.**

16. **S. Californica,** Bebb. The capsule is rarely glabrous or nearly so.

Page 114. **3. CHAMÆCYPARIS.**

Bentham & Hooker (Gen. Pl. iii. 426) refer this genus to *Thuya,* from which it appears to be sufficiently distinct.

Page 120. **8. PSEUDOTSUGA.**

1. **P. Douglasii,** Carr., var. **pendula,** Engelm. Ms. "Branches, at least the lower ones, very slender and long-dependent, often 8 or 10 feet long."

Valleys and slopes about Mount Shasta, *Sisson.*

Page 121. **9. TSUGA.**

2. **T. Pattoniana,** Engelm. Ebbett's Pass is erroneously mentioned in connection with the range of the species, which extends probably to the south of the head of the San Joaquin River. This pass, now unused, is in Alpine County to the north of Silver Mountain.

Page 122. **11. PINUS.**

The pollen-grains in this genus should have been described as .025 to .045 of a line long, instead of .02 to .03 as stated.

Page 132. **2. CORALLORHIZA.**

2. **C. Mertensiana,** Bong. Flowers red; lip oblong, often with a small narrow acute tooth on each side below the middle; spur conspicuous: capsule reflexed.

Forests of Humboldt County, *V. Rattan.*

Page 134. **4. HABENARIA.**

3ª. **H. flagellans.** Stout, nearly 2 feet high: leaves narrowly lanceolate, acuminate; bracts linear-lanceolate, foliaceous, equalling or exceeding the white flower:

spike loose: sepals oblong-lanceolate, 3 lines long, the upper a little broader: petals falcate, narrow; lip linear with a broad rhombic base, 5 lines long; spur slender, 8 lines long, equalling the narrow sessile ovary: pollen-masses attached by a short pedicel to a large oblong gland; beak of stigma broad and rounded: capsule linear-oblong, 9 lines long.

Indian Valley, Plumas County, *J. G. Lemmon.*

Page 135. **5. SPIRANTHES.**

2. **S. porrifolia,** Lindl. Flowers yellowish, narrow, the petals and upper sepal linear; lip dilated at base, oblong and undulate above.

Sierra Valley, *Lemmon.*

Page 138. **10. CYPRIPEDIUM.**

2. **C. Californicum,** Gray. Stem 1 to 4 feet high, 3–12-flowered: capsule narrowly oblong, 8 to 15 lines long, on reflexed pedicels. — Plumas County, *Mrs. Austin.*

Page 139. **1. IRIS.**

1. **I. macrosiphon,** Torr. In Placer County, *Bigelow, Mrs. M. E. P. Ames.*

4. **I. longipetala,** Herb. Oregon, *J. Howell.*

Page 141. **2. SISYRINCHIUM.**

2. **S. Californicum,** Ait. f. The specimens from Plumas County (Indian Valley, *Lemmon*, and American Valley, *Miss S. A. Plummer*) differ from the usual form in their much more slender habit, the scapes less than a line broad, and the obscurely nerved leaves scarcely more than a line wide; perhaps distinct.

3. **S. grandiflorum,** Dougl. Capsule globose, nearly 3 lines in diameter: seeds angled, a line long.

Page 143. **1. AGAVE.**

* * * *Flowers in pairs or fours, densely spicate; perianth campanulate, the tube 3 or 4 times shorter than the lobes.*

4. **A. Utahensis,** Engelm. Acaulescent: leaves very thick, glaucous, attenuate from a broad base, 6 to 12 inches long, 1 to 1¾ wide, terminated by a pale or dusky nearly triangular spine an inch or two long; margin armed with stout straight spiny teeth 1½ to 2 lines long: scape 5 to 7 feet high including the spike (1 or 2 feet); bracts subulate: flowers small, yellow, on pedicels 3 lines long or less; perianth ½ inch long, about equalling the ovary: stamens on the middle of the tube, exserted: capsule oblong, shortly pointed, 10 to 12 lines long. — Bot. King Exp. 497, and l. c. 308.

On mountain ranges in the desert, northeast of San Bernardino (*S. B. Parish*); Arizona and Southern Utah.

Page 184. **29. TOFIELDIA.**

Mr. Baker (Journ. Linn. Soc. xvii. 490) proposes the genus *Triantha* for Nuttall's section of that name, distinguishing it by the scarcely sufficient characters which are given in the note to *Tofieldia.* He recognizes but one species on the Western Coast.

Page 187. **1. LYSICHITON.**

1. **L. Kamtschatcensis,** Schott, Gen. Aroid. t. 91. Engler (in DC. Monogr. Phaner. ii. 210) refers all the forms to one species.

Page 211.

1. WASHINGTONIA.

Flowers perfect, solitary, nearly sessile upon the slender branches of the panicle, scarious-coriaceous; calyx tubular, rigid, with short rounded lacerate overlapping lobes; corolla twice longer, 3-parted, the lanceolate segments reflexed above the broad claw. Stamens 6; filaments narrow, fleshy above the adnate base, exserted and attenuate. Carpels united, the elongated styles coherent into a filiform horny tube.

Collected near San Bernardino in May, 1880, by *Mr. W. G. Wright*, who alone has obtained flowering specimens and whose exertions to this end deserve much credit. He has also received the immature fruit of what may prove to be a second species, said to come from a much larger sized tree and to be found a hundred miles or more to the east of San Bernardino.

2. ERYTHREA, Watson.

2. **E. armata,** Watson. What appears to be the fruit of this species has been brought by the Indians to Mr. Wright of San Bernardino, from trees growing in the interior of that county. They also brought to him a small black fruit which is referable to neither of these genera. The closer attention of collectors is invited to the representatives of this order in that region.

Page 246.

8. CAREX.

59. **C. brevipes.** Upon farther examination this proposed species must be taken to be a variety of *C. globosa.* It differs from the latter in its shorter stem, in the greater length of the lower bract of the upper spikes, which is as broad as the leaves and much longer than the culm, and in its narrowly obovoid perigynia, which are longer attenuate below, and nerveless, but finely striate towards the base. In both, the fibres of the lower sheaths are sparingly reticulate, the leaves scabrous, the style enlarged at base, erect, jointed, and deciduous. — *W. Boott.*

Page 331.

1. EQUISETUM.

5. **E. lævigatum,** A. Br. Penitencia Cañon, Santa Clara County, *Mrs. A. E. Bush.*

Page 332.

1. BOTRYCHIUM.

3. **B. Virginianum,** Swartz. In the Sierra Nevada, but locality uncertain, *F. A. Miller.*

Page 342.

8. ADIANTUM.

2. **A. emarginatum,** Hook. — *A. Jordani,* Muell. in Bot. Zeit. xxii. 25, t. 1, fig. 1.

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APPENDIX.

I.

GLOSSARY.

A- (or *an-*), a prefix in words of Greek derivation, the *a privative*, having a negative signification and denoting the absence of some organ or quality.

Abnormal. Contrary to rule; deviating from the *normal* or usual.

Abortion. The suppression or imperfect development of any part.

Abortive. Imperfectly developed.

Abrupt, abruptly. Indicating a sudden transition or termination; *abruptly pinnate*, pinnate without a terminal leaflet.

Acaulescent. Stemless or apparently so.

Accumbent cotyledons. Having an edge against or towards the radicle.

Acerose. Needle-shaped, as a pine-leaf.

Achenium. See *Akene.*

Achlamydeous. Without perianth.

Aciculur. Needle- or bristle-shaped; more slender than *acerose.*

Acinaciform. Scymetar-shaped.

Acotyledon. A plant whose embryo is without cotyledons, as *Cuscuta;* applied also to cryptogams as plants without seed or embryo.

Acrogenous. Growing by terminal buds.

Aculeate. Having sharp points or prickles.

Acuminate. Tapering to a point.

Acute. Sharp at the end, or at the edge or margin.

Adnate. United; used properly of the surfaces of different organs, as of calyx and ovary.

Adventive. Accidentally present.

Æstivation. The arrangement of leaves or of the parts of the perianth in the bud.

Aggregated. Crowded together, but not coherent.

Akene; Achenium. A dry hard indehiscent 1-celled and 1-seeded seed-like fruit.

Ala, pl. *Alæ.* A wing, or sometimes an axil; in mosses, applied to the basal lobes or auricles of the leaves.

Alar. In the axils or forks; also belonging to the wings or auricles.

Albumen. The nutritive material of the seed, within its coats and exterior to the embryo.

Albuminous. Provided with albumen.

Alliaceous. Applied to the peculiar smell and taste of garlic and onions.

Alpine. Peculiar to high altitudes, above the line of tree-growth.

Alternate. Following one another at intervals, as leaves upon a stem; following by turns; not opposite; intermediate.

Alveolate. Honey-combed; deeply and closely pitted.

Ament. A unisexual spike with scaly bracts, as in the willow.

Amorphous. Without definite form; of abnormal form.

Amphigastria. In Hepaticæ, small stipule-like accessory leaves on the under side of the stem.

Amphitropous. Applied to an inverted ovule or seed with the hilum lateral.

Amplexicaul. Of leaves, clasping the stem.

Anatropous. Of an inverted ovule or seed with the rhaphe extending its whole length.

Ancipital. Two-edged.

Androgynous. Having both male and female flowers.

Angiospermous. Bearing seeds in a closed pericarp.

Annual. Of only one year's duration.

Annular. Having the form of a ring.

Annulus. In mosses, the ring of cells between the operculum and the orifice of the capsule.

Anterior. Equivalent to inferior or lower, in the sense of away from the axis and toward the bract.

Anther. That part of the stamen which contains the pollen.

Antheridium. In cryptogams, the male organ of inflorescence, corresponding to the anther.

Antheriferous. Bearing anthers.

Antherizoids. In cryptogams, the minute usually ciliated organs developed by the antheridia, corresponding to pollen-grains.

Apetalous. Having no corolla or inner perianth.

Apex. The tip or summit of a thing.

Aphyllous. Not bearing leaves.

Apical. At the apex.

Apiculate. Abruptly terminated by a short point or tip.

Apophysis. In mosses, an enlargement of the pedicel at the base of the capsule.

Appendage. Something added or attached to an organ, but unessential to it.

Appressed. Pressed close.

Apterous. Not winged.

Aquatic. Growing in water.

Arachnoid. Resembling cobweb.

Arborescent. Becoming a tree or tree-like.

Archegonium. In mosses, the rudimentary organ which develops into the fruit.

Arcuate. Arched; bent like a bow.

Areola, pl. *Areolæ.* The spaces in any reticulated surface.

Areolate. Divided into small spaces or areolæ.
Areolation. Any system of cellular or reticulated markings.
Aril. An expanded appendage to the hilum, enveloping the seed.
Arillate. Having an aril.
Arilliform. Resembling an aril.
Aristate. Having an awn.
Aristulate. Having a very small awn.
Articulated. Jointed.
Ascending. Rising somewhat obliquely, not erect.
Asteroid. Having a flower resembling that of an Aster.
Attenuate. Narrowing gradually ; tapering.
Auricle. A small ear-like lobe at the base of a leaf.
Auriculate. Furnished with auricles.
Awl-shaped. Shaped like the point of an awl; narrowing above to a sharp point from a rather broad base.
Awn. A bristle-like terminal or dorsal appendage.
Awned. Furnished with an awn.
Axil. The angle formed by a leaf or branch with the stem.
Axile or *Axial.* Situated in the axis or relating to it.
Axillary. Situated in an axil.
Axis. The central line of a body in the direction of its length ; the stem.

Baccate. Berry-like ; pulpy.
Banner. A name often applied to the standard or upper petal of a papilionaceous flower.
Barb. A sharply reflexed point upon an awn, etc., like the barb of a fish-hook.
Barbed. Furnished with barbs.
Bark. The outer covering or rind of a stem.
Basal. At, from, or relating to the base.
Base. The end next the point of attachment or support ; the lower end.
Basifixed. Attached by the lower end.
Basilar. See *Basal.*
Beak. A prolonged tip.
Beaked. Ending in a beak.
Berry. A simple fruit of which the whole substance, excepting the seeds, is pulpy.
Bi- or *Bis-.* A Latin prefix signifying two or twice, as *bibracteate*, with two bracts ; *bidentate*, with two teeth ; *biternate*, twice ternate.
Bifarious. In two ranks.
Bifid. Two-cleft.
Biloculur. Two-celled.
Bipinnate. Twice pinnate.
Biserrate. Doubly serrate.
Bisexual. Having both stamens and pistil, or corresponding organs (in cryptogams).
Bladdery. Thin and inflated.
Blade. The expanded portion of a leaf.
Bract. A leaf or modification of a leaf subtending a flower or flower-cluster.
Bracteate. Having bracts.
Bracteolate. Having bractlets.
Bractlet. A secondary bract upon the pedicel of a flower.
Branch. A division of a stem.
Branchlet. A secondary or ultimate division of a stem.
Bristle. A stiff hair or bristle-like appendage.
Bud. The early rudimentary form of a stem or branch, or an unexpanded flower.
Bud-scales. The scales which form the outer coats of a leaf-bud.
Bulb. A subterranean roundish body, formed of fleshy scales or coatings, essentially a rudimentary stem or leaf-bud, and at length developing a flowering stem and often leaves.
Bulbiferous. Bulb-bearing.
Bulblet. A small bulb formed in the axil of a leaf or bract.
Bulbous. Producing bulbs ; bulb-like.

Caducous. Falling very early ; not at all persistent.
Calcarate. Spurred.
Callus. A callosity or hard protuberance.
Calycine. Relating to the calyx.
Calyculate. Having an involucre resembling a second external calyx.
Calyptra. In mosses, the hood which at first covers the capsule.
Calyx. The outer envelope of a flower.
Campanulate. Bell-shaped or cup-shaped, with broad base.
Canaliculate. Channelled ; having a longitudinal groove.
Canescent. Hoary with a grayish pubescence or puberulence.
Capillary. Very slender and hair-like.
Capitate. Subglobose and terminal, like a head ; collected in a head.
Capitellate. Diminutive of *capitate.*
Capsular. Relating to or like a capsule.
Capsule. A dry dehiscent fruit formed from a compound pistil ; the fruit of mosses.
Carina. A keel, a prominent longitudinal ridge along the middle of a convex dorsal surface ; applied also to the coherent lower petals of a papilionaceous flower.
Carinate. Keeled.
Caryopsis. A seed-like fruit with the very thin pericarp adherent throughout to the real seed, as in most grasses.
Carpel. A simple pistil or one of the several parts of a compound pistil.
Carpophore. A prolongation of the axis between the carpels, as often in the Umbelliferæ.
Cartilaginous. Firm and tough like cartilage.
Caruncle. An outgrowth or expanded appendage at the base of a seed ; sometimes applied to an enlargement of the rhaphe.
Catkin. A scaly unisexual spike ; an ament.
Caudate. Having a tail or slender tail-like appendage.
Caudex. The trunk of a palm or other arborescent endogen ; or the persistent base of any herbaceous perennial.
Caudicle. In orchids, the slender foot-stalk of the pollen-masses.
Caulescent. Having a manifest stem.
Cauline. Belonging to the stem.

Cell. A cavity or separate inclosure, as of an ovary or anther; a minute sac or hollow structure, the unit of all cellular tissue.
Cellular. Composed of such minute cells.
Centrifugal. Developing from the centre outward, as in the cyme.
Centripetal. Developing from the margin toward the centre, or from below upward, as in the corymb, raceme, etc.
Cernuous. Nodding, usually indicating less inclination than pendulous.
Cespitose. Growing in tufts or turf-like; forming mats.
Chaff. Small dry scales, usually membranous or scarious.
Chalaza. The proper base of an ovule, at a point opposite its orifice.
Channelled. Having a deep longitudinal groove, like a gutter.
Chartaceous. Having the texture of parchment or writing-paper.
Chlorophyll. The green matter within the cells of plants.
Chlorophyllose. Containing chlorophyll.
Ciliate. Having the margin, or sometimes the nerves, fringed with hairs.
Ciliola, pl. *Ciliolæ.* Diminutive of the next; in mosses, the hair-like processes between the *cilia.*
Cilium, pl. *Cilia.* A marginal hair; applied in mosses to the slender teeth of the inner peristome.
Cinereous. Ash-gray, the color of wood-ashes.
Circinate. Coiled from the tip into a spiral.
Circumscissile. Dehiscing by a transverse circular line of division.
Cirrhose. Tendril-bearing.
Clavate. Club-shaped; enlarged gradually toward the summit.
Claw. The elongated narrow base of a petal.
Cleft. Cut somewhat deeply, usually about half-way to the centre or midrib.
Climbing. Rising by the aid of some support.
Clustered. Collected near together.
Coalescent. United; used properly in respect to similar parts, as the stamens in Malvaceæ.
Coated. Composed of coats or layers, as an onion.
Cohesion. The sticking together of parts, or their more intimate coalescence or adnation.
Collateral. Side by side.
Collum. In mosses, an obconical thickening of the pedicel continuous with the capsule.
Colored. Of other color than green.
Columella. The persistent axis of a capsule.
Column. A body formed by the union of filaments (stamineal) or, in orchids, of the stamens and pistil.
Coma. A tuft of hairs, especially upon a seed.
Commissure. The surface by which two carpels cohere, as in Umbelliferæ.
Common. Belonging equally to more than one.
Comose. Having a coma.
Complanate. Flattened; of leaves upon a stem, lying nearly in the same plane.
Complicate. Folded together.
Compound. The opposite of *simple;* consisting of more than one; divided.
Compressed. Flattened laterally.
Conduplicate. Doubled together lengthwise, of leaves.
Cone, or *Strobile.* A dry multiple fruit formed of densely imbricated scales.
Confervoid. Of slender diffuse filamentose structure, like *Conferva* among the Algæ.
Confluent. Blended or running together.
Congested. Crowded together.
Conglomerate. Clustered densely together.
Conical. Shaped like a cone; narrowing to a point from a circular base.
Coniferous. Bearing cones.
Conjugate. Arranged in single pairs.
Connate. United in one; growing together.
Connective. The portion of the filament which connects the cells of the anther.
Connivent. Coming in contact; converging together.
Constricted. Contracted or drawn together, as a bag by its string.
Continuous. Not interrupted by joints or otherwise.
Contorted. Twisted; in æstivation, an equal and uniform somewhat oblique overlapping and rolling up of the parts of the circle.
Contracted. Reduced in width or length.
Convolute. Rolled together from one edge. See *Contorted.*
Cordate. Heart-shaped, i. e. ovate with rounded lateral lobes projecting beyond the base and forming a sinus.
Coriaceous. Of the stiffness and consistence of leather.
Corky. Resembling cork.
Corm. A solid fleshy rounded or depressed subterranean body, the base of a stem and bulb-like in appearance.
Corneous. Of the consistence of horn; horny.
Corolla. The inner perianth, within the calyx, consisting of the petals.
Corona, or *Crown.* An appendage at the throat of the corolla, or a crown-like margin at the top of a seed or other organ.
Coronate. Having a crown.
Cortex. The bark, or similar outer covering.
Cortical. Relating to the cortex.
Corticated. Having a cortex.
Corymb. A flat-topped or convex open inflorescence, with short axis, flowering from the margin inward; a depressed raceme.
Corymbose. In corymbs or resembling a corymb.
Costa. A rib, mid-rib, or mid-nerve.
Costate. Having one or more longitudinal ribs or nerves.
Cotyledons. The seed-lobes or leaves of the embryo.
Crateriform. Shaped like a goblet or shallow cup.
Creeping. Running upon or under the ground and rooting.
Crenate. Scalloped; having rounded teeth with shallow acute sinuses.
Crenulate. Finely crenate.
Crested. Having an elevated ridge or appendage like the crest of a helmet.
Cribrose. Perforated, like a coarse sieve.

Cristate. Crested.
Crown. See *Corona.*
Cruciferous. Belonging to the Cruciferæ, with *cruciform* or cross-shaped corolla.
Crustaceous. Hard and brittle.
Cryptogamous. Flowerless, fructifying without the agency of proper stamens and pistils.
Cucullate. Shaped like a hood or cowl, concave and somewhat arched, or like an ovate leaf with edges inrolled; in mosses, applied to a conical calyptra cleft at one side.
Culm. The hollow jointed stem peculiar to grasses.
Cultrate, or *Cultriform.* Shaped like a coulter or broad knife-blade.
Cuneate, or *Cuneiform.* Wedge-shaped; triangular with the angle downward.
Cupule. A cup-shaped involucre inclosing a nut, as of an acorn.
Cupuliferous. Cupule-bearing.
Cusp. A sharp rigid point.
Cuspidate. Terminating in a cusp.
Cut. Cleft or incised.
Cuticle. The outer skin or epidermis; the thin outer layer of the bark.
Cyathiform. Cup-shaped with a somewhat flaring mouth.
Cylindraceous. Somewhat or nearly cylindrical.
Cylindrical. In the form of a cylinder.
Cyme. A broad and flattish inflorescence, flowering from the centre outward.
Cymelet. A small cyme.
Cymose. In cymes or cyme-like.

Decidnous. Falling off after a time; not persistent.
Declinate, or *Declined.* Bent or curved downward.
Decompound. Repeatedly compound or divided.
Decumbent. Reclining at base, the summit ascending.
Decurrent. Running down the stem, applied to a leaf prolonged below its insertion.
Decussate. In pairs alternating at right angles, or similarly in threes.
Definite. Of a constant number, not exceeding twenty; limited or determinate, as *definite inflorescence,* in which a flower terminates the axis.
Deflexed. Bent or turned down abruptly.
Dehiscence. The regular opening of a capsule or anther-cell at maturity; the longitudinal splitting of the teeth in mosses, etc.
Dehiscent. Opening regularly by valves, slits, etc.
Deltoid. Having the shape of the Greek letter *delta,* Δ; broadly triangular.
Dendroid, or *Dendroidal.* Tree-shaped; branching in the form of a tree.
Dentate. Toothed; having symmetrical teeth projecting straight outward.
Denticulate. Minutely toothed.
Depauperate. Impoverished; reduced in size by unfavorable surroundings.
Depressed. Somewhat flattened from above.
Determinate. Limited. See *Definite.*
Dextrorse. Toward the right hand; applied to spirals as seen from without. It is frequently used as if the spiral were seen from within, in which case it indicates just the opposite direction.
Di-, Dis-. A prefix in Greek words signifying two or twice.
Diadelphous. In two sets or clusters.
Diandrous. Having two stamens.
Dicarpellary. Consisting of two carpels.
Dichotomous. Forking regularly by pairs.
Dichinous. Of separate sexes; unisexual.
Dicotyledonous. Having an embryo with two cotyledons.
Didymous. In pairs; twin.
Didynamous. Having four stamens disposed in two unequal pairs.
Diffuse. Widely spreading; widely and loosely branched.
Digitate. Fingered; applied to a compound leaf having the leaflets all diverging from the top of the petiole.
Dimerous. Having all the parts in twos, as the sepals, petals, stamens, etc., of a flower.
Dimidiate. Halved, as though one-half were wanting.
Dimorphous. Occurring in two forms.
Diœcious. Unisexual, the flowers of different sexes borne by separate plants.
Diœcio-polygamous. Diœcious with some perfect flowers intermixed.
Diphyllous. Two-leaved.
Dipterous. Two-winged.
Disciform. In the shape of a disk, depressed and circular.
Discoid. In compound flowers, having disk-flowers only, without rays.
Disk. A dilation or development of the receptacle around the base of the pistil. In compound flowers, the inner series of tubular flowers as distinct from the marginal ray.
Dissected. Deeply cut or divided into numerous segments.
Dissepiment. A septum or partition separating the cells of an ovary or fruit.
Distichous. Arranged in two vertical rows; two-ranked.
Distinct. Separate; not united.
Divaricate. Widely divergent, nearly at right angles.
Divergent. Receding from each other.
Divided. Cleft to the base or to the mid-nerve.
Dorsal. Upon or relating to the *dorsum,* or back.
Drupaceous. Resembling or of the nature of a drupe.
Drupe. A stone-fruit; a fleshy or pulpy fruit with the seed or kernel inclosed in a hard or stony casing (*putamen*).
Drupelet. A diminutive drupe, as each of the several parts of a blackberry.
Dwarf. Much below the ordinary size of its kind.

E-, or *Ex-.* A Latin prefix having often in botanical terms a privative signification.
Ebracteate. Without bracts.
Ecalcarate. Without spurs.

Echinate. Beset with prickles.
Ecostate. Without costa or midnerve.
Edentate. Without teeth.
Effuse. Very diffuse ; very loosely spreading.
Eglandulose. Without glands.
Elater. In Hepaticæ, a slender elongated cell occurring among the spores, usually containing one or more spiral threads.
Ellipsoidal. Nearly elliptical ; or of solids, elliptical in outline.
Elliptical. In the form of an ellipse, oblong with both ends uniformly and somewhat gradually rounded.
Emarginate. Notched at the extremity.
Embracing. Clasping at base.
Embryo. The rudimentary plantlet formed within the seed.
Emergent, Emersed. Raised above the water ; of the capsule in mosses when barely exserted from its involucral leaves.
Endocarp. The inner layer of the pericarp, lying next to the seed.
Endogenous. Growing from within, instead of by superficial increments, the growth ordinarily being general throughout the substance of the stem.
Endogens. Plants with an endogenous structure.
Ensiform. Sword-shaped, as the leaf of an Iris.
Entire. With the margin uninterrupted, without teeth or division of any sort.
Ephemeral. Lasting but a day or for a very short time.
Epi-. A Greek prefix signifying upon.
Epidermis. The thin membrane forming the outer surface of leaves and young stems.
Epigynous. At or upon the top of the ovary.
Equal. Alike in size, or number, etc. ; more frequently used in respect to length.
Equitant. Astride, of conduplicate leaves which fold over each other in two ranks, as in Iris.
Erect. Upright ; perpendicular to the surface of attachment.
Etiolated. Blanched by darkness.
Eu-. In Greek compounds, good, true, proper ; applied in sectional names to the more typical division of a genus.
Evergreen. Bearing its foliage through all the seasons.
Exalbuminous. Destitute of albumen.
Exceed. To surpass in length.
Excentric. Out of the centre ; one-sided.
Excurrent. Running out, as a nerve projecting beyond the apex or margin of the leaf.
Exocarp. The outer portion of a pericarp.
Exogenous. Growing by successive external layers, as in dicotyledonous plants.
Exogens. Plants having an exogenous structure.
Explanate. Opened out flat.
Exsert, Exserted. Projecting beyond an envelope, as stamens standing out of the corolla.
Exstipulate. Without stipules.
Exterior. Outer.
Extra-axillary. Growing from outside of the axil.
Extrorse. Directed outward.
Falcate, or *Falciform.* Sickle-shaped ; strongly curved and more or less flattened or folded.
Farinaceous. Mealy ; containing or yielding flour or starch.
Farinose. Covered with a white mealy powder.
Fascicle. A close bundle or cluster.
Fascicled. Arranged in close clusters.
Fastigiate. With branches erect, parallel and near together, as in the Lombardy poplar.
Favcolate, Favose. Pitted or honey-combed.
Feather-veined. Pinnately veined.
Ferruginous. Of the color of iron-rust.
Fertile. Capable of producing fruit, as a pistillate flower ; applied also to a pollen-bearing stamen.
Fertilization of plants. The application and action of pollen upon the pistil and ovule, effecting fructification.
Fibrous. Composed of threads or fibres.
Fiddle-shaped. Obovate with a contraction or sinus on each side.
Filament. That part of the stamen which supports the anther ; any thread-like body.
Filamentous. Composed of threads or filaments.
Filiform. Thread-shaped ; long, slender and terete.
Fimbriate. Fringed with narrow processes ; having the margin finely dissected.
Fistular. Hollow and cylindrical.
Flabellate, Flabelliform. Fan-shaped ; dilated and rounded above, from a cuneate base.
Flagellate. Producing *flagellæ*, filiform runners or runner-like branches.
Flagelliform. Long and slender, like a whiplash.
Flavescent. Pale yellow.
Fleshy. Succulent, juicy.
Flexuous, or *Flexuose.* Bent or curving alternately in opposite directions.
Floccose. Bearing or clothed with locks of fine hair or wool.
Floral. Belonging to the flower.
Floret. A small flower ; one of a head.
Foliaceous. Leaf-like in structure and appearance ; leafy.
Foliate. Having leaves, as in *bifoliate*, etc.
Foliolate. Having leaflets.
Follicle. A pod, formed from a simple pistil, dehiscing along the ventral suture only.
Follicular. Pertaining to a follicle or like it in structure.
Foot-stalk. A petiole, pedicel, or other slender support.
Foramen. The narrow orifice at the apex of an ovule.
Forked. Branching equally, or divergently.
Foveate. Pitted ; marked by deep depressions.
Foveolate. Diminutive of the last ; marked by minute pits.
Free. Not adnate or coherent to other organs.
Fringed. See *Fimbriate.*
Frond. The leaf of ferns ; the leaf-like expanded vegetation of some Hepaticæ ; applied also to the peculiar growth of the Lemnaceæ.
Frondose. Frond-like, or bearing fronds.
Fructification. The bearing of fruit, or the organs concerned in the production of fruit.

Fruit. The matured seed- or spore-vessel, of whatever kind, with its appendages and contents.
Frutescent. Shrubby or somewhat so.
Fruticose. Decidedly shrubby.
Fruticulose. Diminutive of the last; shrubby, but small.
Fugacious. Soon falling; of short continuance.
Fulcrate. Subtended or surrounded by bracts, or the like.
Fulvous. Dull brownish or grayish yellow.
Fungous. Spongy; fungus-like.
Funiculus. The stalk of an ovule or seed.
Funnel-form. Tubular, but expanding gradually from the narrow base to the spreading border or limb.
Furcate. Forked; with divergent branches.
Furrowed. Deeply grooved longitudinally.
Fusiform. Spindle-shaped, i. e. tapering toward each end from a thickened middle.

Galea. A helmet; applied to the helmet-shaped portion of the corolla in Labiatæ, Aconitum, etc.; also to the upper lip of some Scrophulariaceæ, though not so shaped.
Galeate. Having a galea.
Gamopetalous. Applied to a corolla whose parts are not distinct but more or less coalescent; monopetalous.
Gamophyllous. With united or coalescent leaves or parts, applied either to corolla or calyx.
Gamosepalous. Having the sepals more or less coalescent.
Geminate. In pairs; binate; twin.
Generic. Relating to the genus.
Geniculate. Bent abruptly at an angle, like the knee.
Genus, pl. *Genera.* The divisions of an Order or Family, each consisting of a more or less clearly defined group of nearly related species.
Germination. The sprouting of a seed; the development of the young plant from the embryo.
Geronlogæous. Belonging to the Old World.
Gibbous. Protuberant; swelling out and somewhat saccate at one side.
Glabrate. Becoming glabrous.
Glabrous. Without hairs, pubescence or roughness.
Gland. Any secreting structure, depression or prominence, on any part of a plant, or any structure having a similar appearance.
Glandular. Bearing glands, or gland-like.
Glaucescent. Somewhat glaucous; becoming glaucous.
Glaucous. Covered with a fine whitish bloom that is easily rubbed off; having a bluish-hoary appearance.
Globose, Globular. Round; spherical, or nearly so.
Glochidiate. Barbed, like a fish-hook.
Glomerate. Closely clustered.
Glomerule. A compact somewhat capitate cyme.
Glumaceous. Glume-like; having glumes; chaffy.
Glume. In grasses, the chaff-like bracts subtending the spikelets.
Glutinous. Viscid; sticky; covered with a sticky secretion.
Grain. The fruit of grasses. See *Caryopsis.*
Gramineous. Relating to or resembling the grasses.
Granular. Composed of small grains or grain-like bodies; rough with grain-like prominences.
Gymnosperms. Plants having naked seeds, or in which the typically naked ovule is fertilized directly by the pollen without the intervention of a stigma.
Gynandrous. Having the stamens adnate to the pistils and style, so as to be apparently borne at or upon its summit, as in Orchids.
Gynobase. A short thick prolongation of the axis or receptacle upon which the pistil rests; sometimes applied to a shortened carpophore.
Gynœcium. A term applied to the pistil or aggregate pistils of a flower.

Habit. The general form and appearance of a plant.
Habitat. The locality or geographical range of a plant.
Hairs. Slender cellular outgrowths from the epidermis of plants, of various forms and kinds.
Hairy. Covered with hairs, more or less loosely.
Halbert-shaped. See *Hastate.*
Hamate. Curved at the end into a hook.
Hamulate. Diminutive of the last.
Hastate. Triangular or arrow-shaped with the basal angles or lobes directed outward.
Head. A cluster of flowers, which are sessile or nearly so upon a very short axis or receptacle; a shortened spike.
Heart-shaped. Cordate; ovate with a sinus between the rounded basal lobes.
Herb. A plant that has no persistent woody growth above the base.
Herbaceous. Having the character of an herb; not woody or shrubby.
Herbarium. A systematically arranged collection of dried plants.
Heterogamous. Bearing two kinds of flowers.
Heterogeneous. Dissimilar; differing in kind.
Heteromallous. Spreading in all directions.
Heteromorphous. Of different forms.
Heterophyllous. Having leaves of different forms.
Heterosporous. Bearing spores of more than one kind.
Hilum. The scar or place of attachment of the seed.
Hippocrepiform. Having the shape of a horse-shoe.
Hirsute. Pubescent with rather coarse or stiff hairs.
Hispid. Beset with rigid or bristly hairs.
Hispidulous. Minutely hispid.
Hoary. Grayish-white with a fine close pubescence.
Homogamous. Having only one kind of flowers.
Homogeneous. Uniform in character, nature or kind.
Homomallous. Secund; turned to one side.

Hood, Hooded. See *Cucullate.*
Hyaline. Transparent; translucent.
Hybrid. A cross between two species, produced by the fertilization of the flower of one species by the pollen of another.
Hypocrateriform, or *Hypocraterimorphous.* The same as salverform.
Hypogæous. Growing or remaining under ground.
Hypogynous. Growing upon the receptacle of the flower at the base of the pistil, and free from the perianth.

Imbricate. Overlapping, as the scales of the several series of an involucre; in æstivation, applied to cases where at least one part of the calyx (or corolla) is wholly external and one wholly internal, as distinct from *convolute*, where none are either wholly external or internal, and from *valvate*, where none overlap.
Immarginate. Not margined or bordered.
Immersed. Growing wholly under water; in mosses, used of a capsule inclosed within its involucral leaves.
Inæquilateral. With unequal sides.
Incised. Irregularly, sharply and deeply cut.
Included. Inclosed by the surrounding organs; not exserted.
Incomplete. Not perfect; wanting some of its parts.
Incubous. Imbricate upward, having the tip of one leaf resting upon the base of the one above it.
Incumbent. Resting upon; of cotyledons, lying with one side toward the radicle; of anthers, lying against the face or inner side of the filament.
Incurved. Curved inward.
Indefinite. Of number, variable or very numerous; indeterminate.
Indehiscent. Not opening regularly by valves or otherwise.
Indeterminate. Of inflorescence, not definitely terminated but continuous with the axis, the lower or marginal flowers being the first to open.
Indigenous. Native to the country.
Induplicate. With margins folded inward.
Indusium. In ferns, the shield- or scale-like covering of the fruit-cluster.
Inferior. Lower; that part of a flower, etc., which is toward the bract; applied also to a calyx that is free from the ovary, and to an ovary that is adnate to the calyx.
Inflated. Bladdery.
Inflexed. Bent or turned abruptly inward.
Inflorescence. The flowering portion of a plant, and especially the mode of its arrangement.
Infra-axillary. Below the axil.
Infundibuliform. See *Funnelform.*
Innate. Borne upon the upper surface of a support, as an anther upon the summit of its filament, the cells dehiscing marginally.
Innovation. A shoot by which the growth and continuance of the plant is prolonged, used especially of mosses.
Inserted. Attached to or growing upon.
Insertion. The place or mode of attachment of an organ.
Internode. The part of a stem between two nodes.
Introrse. Turned inward toward the axis.
Involucellate. Provided with an involucel.
Involucel. An inner or secondary involucre; that which surrounds an umbellet.
Involucrate. Having an involucre.
Involucre. A circle or circles of scales, bracts or leaves, distinct or united, surrounding a flower or flower-cluster; in Umbelliferæ, the bracts subtending the umbel.
Involute. Rolled inward.
Irregular. Not regular; unsymmetrical; with its parts unequal or unlike.
Isomerous. Having an equal number of parts in successive series, as of sepals, petals, stamens, etc.

Jointed. Having joints or nodes.
Julaceous. Resembling an ament.

Keel. A central dorsal ridge, resembling the keel of a boat; the united lower petals of a papilionaceous flower.
Keeled. Carinate; having a keel.
Kernel. The seed within a nut; a grain: properly, the contents of the seedcoats, consisting of the embryo and albumen.
Kidney-shaped. See *Reniform.*

Labellum. A lip, as in Orchids.
Labiate. Lipped; applied to an irregular corolla or calyx which is unequally divided into two parts or lips.
Labiatiflorous. Having flowers with a labiate corolla.
Lacerate. Torn; irregularly and deeply cleft.
Laciniate. Cut into narrow slender teeth or lobes.
Lactescent. Yielding milky juice.
Lacunose. Having numerous pits, depressions or cavities.
Lacustrine. Living in lakes, ponds or swamps.
Lageniform. Gourd-shaped.
Lamella. A thin plate or scale.
Lamellar. Composed of thin plates.
Lamina. The blade or dilated portion of a leaf.
Lanate. Covered with long curled hairs like wool.
Lanceolate. Shaped like a lance-head; tapering upward from a narrowly ovate or subovate base.
Lanuginous. Provided with wool; woolly.
Lateral. At the side; attached to the side.
Lavender-color. A pale grayish blue.
Leaf. The principal organ of vegetation borne by the stem, in which the sap is elaborated for the growth of the plant.
Leaf-blade. The dilated portion of a leaf.
Leaf-bud. A bud which is the rudiment of a branch and tends to develop into one.
Leaflet. A separate division of a compound leaf.
Leafstalk. The footstalk or petiole of a leaf.
Leathery. Resembling leather; coriaceous.
Legume. A normally 1-celled capsule, formed from a single carpel, but dehiscing by two valves, as in the Pea.

Leguminous. Pertaining to or bearing legumes.
Lenticular. Lens- or lentil-shaped; of the form of a double-convex lens.
Lentiginous. Covered with minute dots or freckles.
Liber. The inner and often fibrous layer of bark.
Lid. The top of a capsule separating by transverse dehiscence.
Ligneous. Woody.
Ligule. A small tongue-like or strap-shaped body, applied to the corolla of ray flowers in Compositæ, to the thin appendage at the junction of the blade with the sheath in grasses, etc.
Ligulate. Furnished with a ligule; strap-shaped.
Liguliflorous. Having only flowers with ligulate corollas, as in certain Compositæ.
Liliaceous. Lily-like.
Limb. The dilated and usually spreading portion of a perianth or petal, as distinct from the tubular part or claw; the blade of a leaf.
Limbate. Bordered.
Line. The twelfth part of an inch, nearly equivalent to two millimeters.
Linear. Narrow and elongated, with parallel margins.
Lineate. Marked with lines.
Lineolate. Marked with fine lines.
Linguiform, Lingulate. Tongue-shaped; ligulate.
Lip. Either of the two divisions of a bilabiate corolla or calyx; in Orchids, the upper petal, usually very different from the others.
Littoral. Growing on shores, of the sea, or rivers, etc.
Lobate, Lobed. Divided into or bearing lobes.
Lobe. Any division of a leaf, corolla, etc., especially if rounded.
Locellate. Having its cells subdivided, as the cells of an anther bilocellate by a cross-partition.
Locular. Celled, as bilocular, trilocular, etc.
Loculicidal. Used when the cells of a capsule open by dehiscence through the dorsal suture.
Lodicule. A name applied to the minute hyaline scales in the flower of grasses.
Loment. A legume jointed and usually constricted between the seeds.
Lomentaceous. Bearing or resembling a loment.
Lorate. Strap-shaped; elongated-linear.
Loricate. Covered with imbricated scales.
Lucid. Smooth and shining.
Lunate. Crescent-shaped.
Lurid. Of a dull dirty-brown color.
Lutescent. Yellowish; pale yellow.
Lyrate. Pinnatifid with the terminal lobe largest and rounded, the lower lobes small.

Macro-. A Greek prefix signifying large or long.
Macrospore. In some cryptogams, the larger of the two kinds of spores.
Maculate. Marked with spots or blotches.
Male. Staminate.
Mamillate. Bearing nipple-shaped prominences.
Marcescent. Withering and persistent.
Marginally. Along the edge.
Marginate, Margined. Furnished with a border peculiar in structure or appearance.
Maritime. Belonging to the sea or sea-coast.
Mealy. Covered with a whitish mealy powder.
Medial, Median. Running through the middle longitudinally.
Membranous, Membranaceous. Thin and rather soft and translucent, like membrane.
Microspore. The smaller kind of spore in some cryptogams.
Midrib, or *Midnerve.* The central and principal nerve of a leaf.
Mitriform. Mitre-shaped, i. e. conical and slightly narrowed toward the mouth.
Monadelphous. Having the stamens all united by their filaments into a column or tube.
Monandrous. Having a single stamen.
Moniliform. Resembling a necklace or string of beads; contracted or interrupted at regular intervals.
Monocarpellary. Formed of a single carpel.
Monocarpic. Bearing fruit but once.
Monocotyledon. A plant whose embryo has a single cotyledon.
Monœcious. With stamens and pistils (or their equivalents in cryptogams) in separate flowers upon the same plant.
Monopetalous. Gamopetalous, having the corolla in one piece, at least at base.
Monophyllous. One-leaved; composed of a single leaf.
Monosepalous. Gamosepalous, having the calyx more or less in one piece.
Monospermous. One-seeded.
Mucilaginous. Slimy, like mucilage.
Mucro, Mucronation. A short and small abrupt tip.
Mucronate. Terminating in a mucro.
Mucronulate. Ending with a minute mucro.
Multicipital. Many-headed, applied to a much-branched rootstock.
Multifarious. Arranged in many ranks.
Multifid. Cleft into many lobes or segments.
Multijugate. Consisting of many pairs.
Multilocular. Many-celled.
Muricate. Rough, with short hard points.
Muriculate. Finely muricate.
Mutticous. Blunt; without a point.

Naked. Bare; without its usual appendages or covering, as a stem without leaves.
Navicular. Boat-shaped.
Nectar. A sweet secretion within a blossom.
Nectariferous. Secreting nectar.
Nectary. Any part or appendage of a flower which may be supposed to secrete nectar.
Nerve. A simple vein; a rib.
Nerved. Having nerves.
Netted. Reticulated; cross-veined like a net.
Nodding. Hanging down; somewhat inclined from the perpendicular.
Node. A knot or swelling; a place upon a stem where a leaf or whorl of leaves is borne.
Nodose. Having knots or swelling joints.

Normal. According to rule or standard; not varying from the type.
Numerous. Indefinite in number.
Nut. A hard indehiscent one-seeded fruit, usually resulting from a compound ovary.
Nutlet. A small nut; also applied to the hard seedlike divisions of the fruit of the Labiatæ, Verbena, etc.

Ob-. A Latin prefix usually signifying inversion, or the reverse of the primary word.
Obcompressed. Flattened contrary to the direction of the sides, dorsally, instead of laterally.
Obconical. Resembling an inverted cone.
Obcordate. Inverted cordate, the lobes directed outward.
Oblanceolate. Inverted lanceolate, with the broadest part toward the apex.
Oblique. Turned to one side; unequally sided.
Oblong. Considerably longer than broad and with nearly parallel sides.
Obovate. Inverted ovate, the broader part toward the apex.
Obovoid. Inverted egg-shaped, the broader part above.
Obtuse. Blunt or rounded at the end.
Obversely. In a reverse manner.
Ochraceous. Ochre-color, light yellow with a tinge of brown.
Ochroleucous. Yellowish white.
Ocreate, or *Ochreate.* Furnished with an *ocrea*, a tubular stipule sheathing the stem.
-Oid (*-oides*). A Greek termination signifying resemblance.
Opaque. Dull, not shining.
Operculate. Provided with an operculum.
Operculum. A lid, separating by a transverse line of dehiscence.
Opposite. Standing against or facing each other, as a stamen against a petal, or two leaves at the same node.
Orbicular. Circular or nearly so.
Order. A principal group next above the genus in rank, and including related genera more or less distinguished from others by certain common characters.
Ordinal. Relating to orders.
Organ. Any part of a plant concerned in its growth and welfare, having a special object to serve and more or less essential.
Orthotropous. Applied to an ovule or seed that is straight and attached immediately by its base.
Osseous. Bony.
Oval. Broadly elliptical.
Ovary. The dilated portion of the pistil, bearing and containing the ovules.
Ovate. Shaped like the longitudinal outline of an egg, the broader portion toward the base; also egg-shaped and applied to solids.
Ovoid. Egg-shaped.
Ovule. A rudimentary organ which after impregnation becomes a seed.
Ovuliferous. Bearing ovules.

Palate. A protrusion of the lip of a bilabiate corolla.
Palea. A chaff or chaffy bract; in grasses, the two inner bracts of the flower.
Paleaceous. Chaffy or furnished with chaff.
Palet. The same as *palea*, used especially of grasses.
Palmate. Of leaves, compound with the leaflets radiating from the summit of the petiole.
Palmately. In a palmate manner.
Palmatifid. Palmately cleft or divided.
Pandurate. See *Fiddle-shaped.*
Panicle. A loose irregularly branched inflorescence.
Panicled, *Paniculate.* After the manner of a panicle; bearing a panicle.
Papilionaceous. Butterfly-like; applied to the peculiar irregular flower common in the Leguminosæ.
Papillose, *Papillate.* Bearing minute thick nipple-shaped or somewhat elongated projections.
Pappus. In Compositæ, the hairs, bristles, or scales crowning the akene and taking the place of a calyx.
Papyraceous. Having the texture of paper.
Paraphyses. In mosses, the minute filiform bodies which accompany the male and female organs.
Parasitic. Growing upon and deriving nourishment from another plant.
Parenchyma. The soft cellular tissue of plants, as the green fleshy part of a leaf.
Parenchymatous. Like or formed of parenchyma; also applied to cells narrower at the ends and overlapping each other.
Parietal. Relating to or situate upon the walls of a cavity.
Paripinnate. Evenly or abruptly pinnate, the terminal odd leaflet wanting.
Parted. Cleft nearly to the base.
Partial. Secondary as distinguished from the principal and primary.
Partition. An inner wall or dissepiment.
Patelliform. Trencher-shaped, with the margin less raised than in Scutelliform.
Patent. Widely spreading.
Patulous. Slightly or moderately spreading.
Pauciflorous. Few-flowered.
Pear-shaped. Obovoid or obconical with a somewhat tapering base and usually oblique or unsymmetrical.
Pectinate. Comb-like: cleft with narrow closely set segments.
Pedate. Palmately divided or parted with the lateral divisions again 2-cleft.
Pedicel. The footstalk or support of a flower.
Pedicellate. Borne on a pedicel.
Peduncle. A general or primary flower-stalk.
Pedunculate. Furnished with a peduncle.
Peltate. Shield-shaped; flat and attached to its support by its lower surface.
Pendent. Hanging on its stalk or support.
Pendulous. Hanging nearly inverted from its support; of ovules, more or less drooping, as distinct from suspended.
Penicillate. Resembling a brush of fine hairs.
Pepo. A cucurbitaceous fruit.
Perennial. Persistent a series of years.

Perfect. Of a flower, having both stamens and pistil.
Perfoliate. Of leaves, connate about the stem.
Perianth. The floral envelopes, i. e. the calyx and corolla, so far as present.
Pericarp. The seed-vessel or ripened ovary.
Perichætium. The leafy involucre surrounding the archegonium and base of the pedicel in mosses.
Perigynium. The sac-like envelope or the bristles or scales which in Cyperaceæ represent the perianth.
Perigynous. Surrounding the ovary but adnate to the perianth.
Peristome. In mosses, the fringe of teeth or hairs at the orifice of the capsule.
Persistent. Not falling off; of leaves, continuing through the winter.
Personate. Used of a labiate corolla with prominent palates closing the throat.
Petal. One of the parts of a polypetalous or nearly divided corolla.
Petaloid. Colored and resembling a petal.
Petiolar. Borne upon or relating to a petiole.
Petiole. The footstalk of a leaf.
Petioled, Petiolate. Having a petiole.
Petiolule. The footstalk of a leaflet.
Phænogam. A *phænogamous* plant, fructifying by means of stamens and pistils.
Phanerogam. The same as *Phænogam.*
Phyllode. A leaf reduced to a simple petiole, which may be more or less dilated vertically.
Piliferous. Bearing or tipped with hairs.
Pilose. Hairy, usually with soft distinct hairs.
Pinna. One of the principal divisions of a compoundly pinnate leaf.
Pinnate. Having its parts arranged in pairs along a common rhachis.
Pinnately. In a pinnate manner.
Pinnatifid. Pinnately cleft into opposite nearly equal segments.
Pinnatisect. Pinnately divided down to the midrib.
Pinnule. A secondary pinna, i. e. one of the pinnate divisions of a pinna.
Pisiform. Resembling a pea in shape and size.
Pistil. The female organ of a phænogam, consisting of the ovary with its styles and stigmas.
Pistillate. Having a pistil and no stamens, as distinct from perfect or staminate.
Pistillidium. See *Archegonium.*
Pith. The soft and spongy central cellular part of a stem.
Pitted. Marked with small depressions or pits.
Placenta. That part of the ovary or fruit which bears the ovules and seeds.
Plane. Having a flat surface.
Plicate. Folded into plaits, like a fan.
Plumose. Plume-like; having fine hairs on each side like a feather.
Plumule. The bud or growing point of the embryo between the cotyledons.
Pluri-. In compound words, several; as *pluri-foliolate,* with several leaflets, etc.
Pod. A capsule, usually of cruciferous or leguminous plants.
Pointless. Without a point, blunt.
Pollen. The powdery or sometimes waxy contents of the anther.
Poly-. In compound words, many; as *poly-androus,* having many stems.
Polygamous. Having both perfect and unisexual flowers upon the same plant.
Polymorphous. Of many forms; variable in form.
Polypetalous. Having distinct petals.
Pome. A fleshy fruit, like the apple, enclosing several parchment-like or bony carpels.
Posterior. In an axillary flower, the side toward the axis and away from the bract.
Præmorse. Terminating abruptly, as if bitten off.
Prickle. A small spine, an outgrowth of the bark or cuticle.
Process. Any projecting appendage; in mosses, the inner teeth or cilia of the peristome.
Procumbent. Lying upon the ground.
Produced. Extended or prolonged.
Proliferous. Producing offshoots.
Prosenchymatous. Formed of more or less elongated tubular cells placed end to end.
Prostrate. Lying flat on the ground.
Prothallus. In the higher cryptogams, the immediate frondaceous or filamentose product of the germination of the spore, upon which are developed sexual organs or new plants.
Pruinose. Covered with a minute bloom or powder.
Pseudopodium. The stalk supporting the capsule in Sphagnaceæ.
Puberulent. Very minutely pubescent.
Pubescent. Covered with hairs, usually short and soft.
Pulverulent. Dusty, as if covered with a minute powder.
Pulvinate. Cushion-shaped; growing in thick mats or cushions.
Punctate. Dotted with minute depressions, or with translucent internal glands or colored dots.
Puncticulate. Very minutely punctate.
Pungent. Terminating in a rigid and stout sharp point or prickle.
Pustular. Having low elevations, like small blisters.
Putamen. The bony or crustaceous shell inclosing the seed of a drupe.
Pyramidal. Shaped like a pyramid; narrowing to an apex from an angular base.
Pyriform. Pear-shaped.

Raceme. A form of inflorescence with pedicellate flowers upon a simple prolonged axis, the flowers developing from below upward.
Racemose. In racemes, or resembling a raceme.
Radial. Belonging to the ray of a compound flower.
Radiate. Diverging from a common centre; bearing ray flowers.
Radical. Belonging to or proceeding from the root, or from the base of the stem.
Radicle. That part of the embryo below the cotyledons, its stem-portion and the primal

internode, developing the root from its lower extremity.

Radiculose. Bearing rootlets or rhizoids.

Rameal. Belonging to a branch.

Ramose. Branching.

Ramulose. Bearing branchlets.

Ray. One of the radiating branches of an umbel; the marginal flowers, as distinct from the disk, of a compound flower, umbel, etc.

Receptacle. A more or less expanded or produced surface forming a common support for a cluster of organs (in a flower) or a cluster of flowers (in a head), etc.

Reclinate, Reclining. With an erect or ascending base, the upper part recurved and trailing.

Rectangular. Of an oblong right-angled figure.

Recurved. Curved backward or downward.

Reflexed. Bent abruptly down or backward.

Refracted. Reflexed from the base.

Regular. Symmetrical in form; uniform in shape or structure.

Reniform. Kidney-shaped; deeply cordate with the breadth exceeding the height.

Repand. With the margin slightly sinuate or wavy.

Replum. A frame-like placenta left by the falling away of the valves, as in Cruciferæ, some Papaveraceæ, etc.

Reticulated. With markings or veinings resembling network.

Retrorse. Turned back or downward.

Retuse. With a shallow or obscure notch at the rounded apex.

Revolute. With the margins or apex rolled backward.

Rhachis. The axis of a spike or of a compound leaf or frond.

Raphe. The adnate funiculus of an ovule or seed, connecting the hilum with the chalaza.

Raphides. Crystals, usually needle-shaped and clustered, within the cells of plants.

Rhizines, or *Rhizoids.* The peculiar root-hairs of Mosses, Lichens, etc.

Rhizomatous. Producing rhizomes or of the character of a rhizome.

Rhizome, or *Rootstock.* A somewhat horizontal underground rooting stem, producing a stem, leaves or flower-stalk at its apex or nodes, often short or tuberous.

Rhombic. Obliquely four-sided.

Rhomboidal. Somewhat rhombic in outline.

Rib. A principal and prominent nerve of a leaf.

Ribbed. Furnished with prominent nerves.

Ringent. Gaping, applied to a labiate corolla with open throat.

Root. That part of a plant growing underground and supplying it with nourishment.

Rootlet. A very slender root or branch of a root.

Rootstock. See *Rhizome.*

Rostellate. Diminutive of *Rostrate;* having a small beak.

Rostrate. Beaked; bearing a slender terminal process.

Rosulate. Collected in a rosette.

Rotate. Wheel-shaped; of a corolla, spreading abruptly from near the base and nearly flat.

Rotund. Rounded in outline.

Rough. Not smooth to the touch; scabrous.

Rudiment. A partially developed and imperfect organ.

Rudimentary. In an imperfectly developed condition.

Rufous. Reddish or brownish red.

Rugose. Wrinkled; ridged.

Ruminated. Penetrated by irregular channels, as a nutmeg.

Runcinate. Deeply toothed or incisely lobed, with the segments directed backward.

Runner. A very slender prostrate branch (stolon), rooting and developing a new plant at the nodes or tip, as in the strawberry.

Saccate. Sac-shaped; furnished with a sac or pouch-like cavity.

Sagittate. Shaped like an arrow-head; triangular with basal lobes prolonged downward.

Salver-shaped. Narrowly tubular with an abruptly expanded flattened limb.

Samara. An indehiscent membranously winged fruit, as in the Ash and Maple.

Sarcocarp. The succulent part of a fleshy fruit.

Sarmentose. Producing long runners.

Scabrous. Rough to the touch with minute rigid points.

Scales. Usually variously modified bracts or leaves, thin and scarious, or coricaceous, fleshy, foliaceous, or woody, often imbricated.

Scandent. Climbing.

Scape. A naked peduncle rising from the ground.

Scapigerous. Producing scapes.

Scar. A mark of separation left upon a surface, as upon a stem by the fall of a leaf.

Scarious. Thin, dry and membranaceous, not green.

Scobiform. Having the appearance of sawdust.

Scorpioid. Incurved like the tail of a scorpion, applied to a unilateral circinately coiled inflorescence, unrolling as the flowers expand.

Scrobiculate. Marked by minute depressions.

Scurf. Small bran-like scales on the epidermis.

Scutelliform. Platter-shaped, with a distinct and raised margin.

Scymetar-shaped. Curved and somewhat flattened triquetrous, thick upon the straighter side, the convex edge thin.

Secund. Turned in one direction, as the leaves or flowers upon a stem.

Seed. The ripened ovule, consisting of the embryo with its proper envelopes.

Segment. One of the parts of a leaf or other organ that is cut or divided; more general than *Lobe.*

Sepal. A leaf or division of a calyx.

Sepaloid. Resembling a sepal.

Septate. Divided by partitions or *septa.*

Septicidal. Dehiscing through the dissepiments and between the cells, or through the lines of junction of the carpels.

Septiferous. Bearing the partitions after dehiscence.

Septifragal. Breaking away from the partitions on dehiscence; terms applied to the valves of a loculicidal capsule.
Septum. Any kind of partition dividing a cavity.
Sericeous. Silky; covered with soft straight appressed hairs.
Series. A row, circle, or rank.
Serotinous. Produced late in the season.
Serrate. Having teeth directed forward, like the teeth of a saw.
Serratures. Teeth like those of a saw.
Serrulate. Finely serrate.
Sessile. Attached immediately to the point of support without footstalk.
Seta. A bristle.
Setaceous. Bristle-like.
Setigerous. Bristle-bearing.
Setose. Beset with bristles.
Sheath. A tubular envelope, investing a stem.
Sheathing. Enfolding like a sheath.
Shield-shaped. Flattened and rounded or polygonal, and borne by a stalk attached to the under surface.
Shrub. A plant woody throughout, of less size than a tree.
Shrubby. Having the character of a shrub.
Sigmoid. Doubly curved, like the letter S, or the Greek *sigma*, Σ.
Silicle. A short cruciferous pod, not many times longer than wide.
Silique. The usually elongated pod in Cruciferæ, having two valves separating from two parietal placentæ.
Silky. See *Sericeous.*
Simple. Of one piece; not compound.
Sinistrorse. Turned to the left, as seen from the outside; but often used in the opposite sense.
Sinuate. With a strongly wavy margin.
Sinuous. Flexuose; curving back and forth.
Sinus. A depression, either angular or rounded, separating lobes or segments.
Smooth. Not rough; sometimes used as equivalent to glabrous.
Sorus, pl. *Sori.* In ferns, a cluster of sporangia.
Spadix. A spike with usually a thickened fleshy rhachis and subtended by a spathe.
Span. The distance between the extremities of the thumb and little finger when extended; about nine inches.
Sparse. Thinly scattered.
Spathaceous. Bearing or resembling a spathe.
Spathe. One or more clasping and often sheathing bracts inclosing a flower cluster or inflorescence and mostly colored.
Spatulate. Narrowly attenuate downward from an abruptly rounded summit.
Species. A group of things of the same kind, having essentially the same characters.
Specific. That which relates to or defines a species.
Spicate. In spikes or resembling a spike.
Spike. Resembling a raceme but the flowers sessile or very nearly so.
Spikelet. A secondary spike; in grasses, the flowers subtended by a common pair of glumes.
Spindle-shaped. See *Fusiform.*
Spine. A sharp woody or rigid outgrowth from the stem, a modification of a branch, leaf or stipule.
Spinescent. Ending in a spine or rigid point.
Spinose, Spiny. Furnished with or resembling spines.
Spinulose. Having diminutive spines.
Spiricles. The microscopic spiral cells within the hairs upon the seeds or akenes of some plants (as Collomia), which are discharged and uncoil when wetted.
Sporangium. In the higher cryptogams, the case which contains the spores.
Spores. In cryptogams, the minute bodies which are the result of fructification and which correspond to some extent to the seeds of phænogams, though without embryo and reproducing the plant only indirectly.
Spur. A usually slender tubular process from some part of a flower, often nectariferous.
Squamose. Furnished with scales.
Squarrose. Roughened and jagged with projections spreading every way, as by the divaricately spreading ends of crowded leaves or bracts.
Squarrulose. Diminutive of the last.
Stamen. The pollen-bearing organ of the flower, consisting of an anther usually supported upon a stalk or filament.
Staminal. Relating to or consisting of the stamens.
Staminiferous. Stamen-bearing.
Staminodium. A sterile stamen or something taking the place of a stamen.
Standard. The broad upper petal of a papilionaceous flower.
Stellate. Star-shaped; radiating in fine lines from a centre, like the rays of an asterisk.
Stem. The main axis of a plant.
Stemless. Without manifest stem above ground.
Sterile. Barren; not capable of producing seed; a sterile stamen is one not producing pollen.
Stigma. That portion of the pistil without epidermis through which the pollen-tubes effect entrance to the ovules, very variable in shape and position.
Stigmatic. Belonging or relating to the stigma.
Stings. Stinging hairs, seated upon a gland which secretes an acrid liquid.
Stipe. The footstalk of a pistil raising it above the receptacle; in ferns, the naked stalk of the frond.
Stipitate. Borne upon a stipe.
Stipular. Belonging to stipules.
Stipulate. Possessing stipules.
Stipule. An appendage to the base of a petiole, very various in form and character.
Stock. A caudex or rhizome; the persistent base of an herbaceous perennial.
Stolon. A horizontal prostrate offshoot from the base of a plant.
Stoloniferous. Bearing or propagating by stolons.
Stoma, pl. *Stomata.* Microscopic openings or "breathing-pores" in the epidermis of leaves, etc., allowing interchange between the outer air and that within the leaf.

Stomatose. Having stomata.
Stone. The hard endocarp or *putamen* of a drupe.
Stramineous. Straw-like or of a straw-color.
Strap-shaped. See *Ligulate.*
Striate. Marked with fine longitudinal lines or furrows.
Strict. Upright and very straight.
Strigillose. Minutely strigose.
Strigose. Beset with short straight stiff and appressed sharp-pointed hairs.
Strobile. An inflorescence formed of imbricated scales, as in the Hop and the Coniferæ.
Strophiole. An appendage at the point of attachment of some seeds.
Struma. In mosses, a wen-like unsymmetrical thickening of the pedicel at the base of the capsule.
Style. That portion of the pistil between the ovary proper and the stigma, usually attenuated, often wanting.
Styliform. Style-shaped.
Stylopodium. A cushion-like expansion at the base of the style in Umbelliferæ.
Sub-. In composition, somewhat or slightly.
Submerged. Growing under water.
Subtended. Supported or surrounded, as a pedicel by a bract, or a flower-cluster by an involucre ; fulcrate.
Subulate. Awl-shaped.
Succubous. Imbricated downward, the apex of each leaf covered by the base of the one above.
Succulent. Fleshy and juicy.
Sucker. A shoot from the underground base of a stem, or from underground roots or rhizomes.
Suffruticscent. Somewhat or slightly shrubby ; woody at base.
Suffruticose. Low and shrubby.
Sulcate. Grooved or furrowed.
Superior. Growing above ; a superior ovary is one wholly above and free from the calyx ; in a lateral flower, nearest to the axis.
Surculose. Producing suckers.
Suspended. Hanging directly downward ; hanging from the apex of a cell.
Suture. A line of union, or of dehiscence.
Sword-shaped. A blade with two thin acute edges, as in Iris.
Symmetrical. Regular in shape or in the number of its parts.
Syncarpous. Composed of two or more united carpels.
Synonym. A superseded or unused name.

Tail. Any long and slender terminal prolongation.
Teeth. Small marginal or terminal lobes of any kind.
Tendril. A thread-like production from an axil, the extremity of a leaf, or elsewhere, capable of coiling and used for climbing.
Terete. Cylindrical or nearly so ; not angled nor channelled.
Ternate. In threes ; with three divisions.
Ternate-pinnate. Ternate with the divisions pinnate.
Tessellated. Chequered ; like mosaic or chequer-work.
Testa. The outer seed-coat.
Tetradynamous. With four long and two shorter stamens ; applied to the Cruciferæ.
Tetragonal. Four-angled.
Tetramerous. Of a flower, having its parts in fours.
Tetrandrous. With four stamens.
Thalloid. Resembling a thallus.
Thallus. In cryptogams, a cellular expansion taking the place of stem and foliage, very various in form.
Thorn. See *Spine.*
Throat. The orifice of a gamopetalous corolla or calyx ; the portion of the corolla immediately below the limb or between the limb and the tube.
Thyrse. A contracted or close ovate panicle.
Tissue. The various forms of cellular and vascular structure of which a plant is composed.
Tomentose. Pubescent with matted wool.
Tomentum. Dense matted woolly pubescence.
Tongue-shaped. Oblong and somewhat fleshy, nearly flat, and rounded at the apex.
Toothed. Provided with teeth.
Top-shaped. Inverted broad-conical.
Torose. Swelling interruptedly ; cylindrical, or somewhat so, with constrictions at intervals.
Tortuous. Twisted.
Torulose. Slightly torose.
Torus. The receptacle of a flower ; the apex of the flower-stalk, more or less modified to support the parts of the flower.
Transverse. Across, from side to side.
Tree. A woody branching plant, with erect trunk, ten feet high or more.
Triandrous. With three stamens.
Triangular. Three-angled.
Trichotomous. Branching by threes.
Trifid. Three-cleft.
Trifoliate. Three-leaved.
Trifoliolate. Having three leaflets.
Trimerous. Having its parts in threes.
Tripinnate. Three times pinnate.
Triquetrous. Of a stem, etc., triangular with the sides somewhat concave or channelled.
Triquinate. Ternate with the divisions again divided into five.
Tristychous. In three vertical ranks.
Triternate. Three times ternate.
Trumpet-shaped. Tubular with a dilated orifice.
Truncate. Ending abruptly as if cut off transversely.
Trunk. A main stem.
Tube. Any elongated hollow body or part of an organ.
Tuber. A thickened rhizome, with scattered buds or eyes.
Tubercle. A small projection or pimple ; a small tuber or a tuberous root.
Tuberculate. Covered with small rounded prominences or knobs.
Tuberiferous. Bearing tubers.
Tuberous. Resembling a tuber.
Tubular. Tube-shaped.
Tubuliflorous. When the flowers of a head have only tubular corollas.

Tunicate. Having concentric coats, as an onion.
Turbinate. Top-shaped.
Twining. Ascending by winding about a support.
Type. The ideal pattern or form.
Typical. That which corresponds to or represents the type. A typical species is one upon which the generic character was founded, or one which conforms most closely to the general characters of the genus, deviations from which form the basis for subgenera, etc. So the typical form of a species is that upon which the specific character is based, as distinguished from all varieties, sports, etc.

Umbel. An umbrella-shaped inflorescence, the pedicels radiating from the summit of the common peduncle.
Umbellate. Bearing or growing in umbels.
Umbellet. A small secondary umbel upon the ray of the primary.
Umbelliferous. Bearing umbels.
Umbellulate. Bearing umbellets.
Umbilicate. Pitted in the centre, navel-like.
Umbonate. Bossed; bearing a stout projection in the centre, like the boss of a shield.
Umbraculiform. Having the form of an umbrella.
Unarmed. Without prickles, spines, or the like.
Uncinate. Hooked at the extremity.
Undulate. Wavy, alternately raised above and depressed below the general plane.
Undershrub. A very low shrub.
Unequal. Not equal; unsymmetrical; *unequally pinnate*, with an odd terminal leaflet.
Unguiculate. Of a petal, narrowed below into a claw or petiole-like base.
Unilateral. One-sided.
Unilocular. One-celled.
Uniovulate. Having a single ovule.
Uniserial. In one horizontal row or series.
Unisexual. Of one sex; of flowers having stamens only or pistils only.
Urceolate. Cylindrical or ovoid, but contracted at or below the open orifice, like an urn or pitcher.
Utricle. A small bladdery usually one-seeded pericarp, indehiscent or bursting irregularly or circumscissile; any small bladder-like organ, or sometimes applied to forms of tissue-cells.
Utricular. Consisting of or belonging to utricles.

Vagina. A sheath.
Vaginate. Sheathed.
Vaginule. A diminutive sheath.
Valleculæ. The grooves between the ribs of the fruit in Umbelliferæ.
Valvate. Opening by valves, as a capsule; meeting by the edges, without overlapping, as sepals, etc., in æstivation.
Valve. The several parts of a dehiscent pericarp; the door-like lid by which anthers sometimes open.
Variegated. Irregularly colored.
Variety. The principal subdivision of a species, differing from the type in certain constant characters of subordinate value.
Vascular. Relating to or composed of elongated tubular cells (vessels, ducts), as distinguished from *cellular*.
Veined. Furnished with veins.
Veinless. Destitute of evident veins.
Veins. Bundles of woody tissue traversing a leaf or other flat surface, and forming its framework, especially those which branch (as distinct from *nerves*).
Veinlet. A small subdivision of a vein.
Velutinous. Velvety; covered with a dense soft fine pubescence.
Venation. The mode of veining.
Ventral. Belonging to the anterior or inner face of a carpel, etc.; the opposite of *Dorsal*.
Ventricose. Swelling unequally or inflated on one side.
Venulose. Abounding with veinlets.
Vermicular. Worm-shaped.
Vernal. Appearing in spring.
Vernicose. Appearing as if varnished.
Verrucose. Covered with wart-like elevations.
Versatile. Swinging; turning freely on its support.
Vertex. The apex of an organ.
Vertical. Upright; perpendicular to the plane of the horizon; longitudinal.
Vertical. A whorl.
Verticillate. Arranged in whorls.
Vesicle. A small bladder or air-cavity.
Vesicular. Composed of vesicles.
Vessels. Elongated tubular cells, of various kinds, forming the vascular tissue of plants.
Vexillum. The standard or large upper palet of a papilionaceous corolla.
Villose, Villous. Bearing long and soft straight or straightish hairs.
Viminous. Bearing long and flexible twigs.
Vine. A trailing, climbing or twining stem.
Virgate. Like a wand or rod, slender, straight and erect.
Viscid, Viscous. Glutinous, sticky.
Vittate. Bearing vittæ.
Vittæ. The longitudinal oil-tubes in the pericarp of most Umbelliferæ.
Viviparous. Propagating by buds or bulblets instead of by seeds, or with the seeds germinating while still on the plant.

Wavy. See *Undulate*.
Waxy. Resembling bees-wax in appearance or consistence.
Wedge-shaped. See *Cuneate*.
Wheel-shaped. See *Rotate*.
Whorl. An arrangement of leaves, flowers, etc., in a circle about the stem or axis.
Wing. Any membranous or thin expansion or appendage; the lateral petal of a papilionaceous flower.
Wood. The hard firm part of a stem, etc., composed mainly of wood-cells (fibro-vascular tissue).
Woolly. Clothed with long and twisted or matted hairs.

IV.

LIST OF PERSONS WHO HAVE MADE BOTANICAL COLLECTIONS IN CALIFORNIA.

By WILLIAM H. BREWER.

THE collection of plants in California for scientific study has been going on for about ninety years, which time may conveniently be grouped into four periods. The first, beginning with the arrival in that country of the earliest botanist, in 1791, and ending with 1848, coincides nearly with the Spanish colonial period. The second, beginning with the great emigration of 1849 and continuing eleven years, covers the Mexican Boundary survey and the several government explorations for a railroad to the Pacific. The third begins with the organization of the State Geological Survey, under Prof. J. D. Whitney, in 1860, and ends with the completion of the Pacific Railroad in 1868; the fourth extending from that date to the present time. I shall here consider only the first three of these periods; for, during the last, so many persons have visited the State and carried away collections, and the local botanists have so increased in number, that it is impracticable for me to enumerate all of them.

In botanical literature, the name *California* has been applied to a wide and vague region, extending from Cape Saint Lucas to Nootka along the coast, and inland to the Rocky Mountains; but this sketch applies only to the territory now known as the State of California.

It will be noticed that these botanical collectors may be grouped into four classes, — those officially connected with various government expeditions and surveys; scientific men visiting the State, but having no connection with government work; persons making collections for sale or for private subscribers, or for botanical gardens and museums; and, finally, resident botanists who have engaged in the work chiefly through their love of it.

The first botanists to visit California were THADDÆUS HAENKE and LUIS NÉE, who accompanied the Spanish expedition under Malaspina, which touched our coast at San Diego and Monterey in 1791. Between 1789 and 1817, Haenke botanized along the western side of the American continent from Patagonia to Behring Strait, without once returning to Europe, and died in Bolivia in 1817. His collections are in part at Prague, and were described by Presl in "Reliquiæ Hænkeanæ," and the rest, with those of Née, are in the herbarium of the Royal Garden at Madrid. Through a confusion of labels, some of his plants described as Chilian were probably collected in California; while some others credited to California were, with little doubt, really from the East Indies or elsewhere.

ARCHIBALD MENZIES, who had earlier visited the Northwest Coast in a trading-vessel (in 1786 or, as some authorities say, in 1779), was surgeon on the English ship *Discovery*, under Captain Vancouver, and visited California on three successive years, each time coming to the American coast from the Sandwich Islands in the spring, spending the summer northward, and passing south in the autumn. In November and December, 1792, he visited Bodega, San Francisco Bay, Santa Clara, and Monterey. In May, 1793, he was at Trinidad Bay, and from October to December of the same year at various places, from Bodega to San Diego, including the islands below Santa Barbara. Again, in November and December, 1794, he touched at several places along the coast from Santa Cruz southward. A set of his collections is in the British Museum, another at Kew, and a portion of his earlier collections, particularly the cryptogams, are in the herbarium of the Botanical Society of Edinburgh.

JOSEF MARIANO MOÇIÑO was on the coast from California to Nootka in the year 1792, at the same time as was Menzies, when Vancouver received from the Spanish the formal surrender of Nootka. He afterwards botanized in Mexico, especially in its northern parts, along with Martin Sessé. The large collection of drawings which Moçiño brought to Europe after the death of

Sessé contains delineations of several Nootka species (such as *Rubus Nutkanus*), and apparently a few from California; but most of them were Mexican. This collection of twelve hundred drawings (cited as Ic. Fl. Mex. ined., and on which a number of genera and species were founded) was left by Moçiño in the hands of De Candolle, but after some years was suddenly reclaimed, upon which occasion copies of most of them were secured by the united labors of the principal ladies of Geneva. It is said that the herbarium made by Moçiño and Sessé went to Madrid; but a portion was certainly acquired by Lambert (see Don, in Trans. Linn. Soc. xvi. 169), and upon the breaking up of his herbarium is thought to have been acquired by the British Museum.

Dr. GEORGE HEINRICH VON LANGSDORFF, who started from Europe on the Russian expedition under Captain Krusenstern, instead of returning with the ships of the expedition, visited California in the ship *Juno*, with Count Resanoff, reaching San Francisco Bay April 9, 1806, and remaining until May 22, making excursions in the mean time about the Bay and to San Jose. Partly owing to mishaps, and partly to the difficulty of drying his specimens on the small ship, his botanical collection was meagre. At this visit, Count Resanoff made arrangements for planting a Russian colony in California, which was accomplished six years later. Dr. Langsdorff is said to have visited the region again in 1824, in connection with the second expedition of Kotzebue to California.

ADALBERT VON CHAMISSO, as botanist, and JOHANN FRIEDRICH [Iwan Iwanowitsch] ESCHSCHOLTZ, as surgeon and naturalist, were on the expedition that was fitted out by Count Romanzoff, under Captain Kotzebue, in the ship *Rurik*, and spent the month of October, 1816, at San Francisco, making excursions to Bodega, San Jose, Monterey, and about the Bay. Descriptions of the plants were published by Chamisso and Schlechtendal in Linnæa, in the ten volumes from 1825 to 1834, and by Dr. Eschscholtz in a short paper entitled "Descriptio Plantarum Novæ Californiæ," in the Memoirs of the Academy of St. Petersburg in 1823. Some of the more notable specimens were the subjects of special papers in other publications, as in Nees's "Horæ Physicæ," in which *Eschscholtzia* was published. Dr. Eschscholtz again accompanied Kotzebue on his second voyage to California, arriving in September, 1824.

The English expedition known as Captain Beechey's (1825 to 1828), on the ship *Blossom*, reached California late in 1827. ALEXANDER COLLIE, surgeon to the expedition, and Mr. G. TRADESCANT LAY, botanist and naturalist, made a collection of about one hundred and seventy-five species. Mr. Seemann (in the introduction to his "Botany of the Voyage of the *Herald*") says that the specimens did not reach Europe in a satisfactory condition, and moreover were mixed up with those of Loo Choo, giving rise to some confusion, but that Messrs. Hooker and Arnott had made the best use of the material in their "Botany of Captain Beechey's Voyage." The specimens, collected at San Francisco Bay, and a few at Monterey, are mainly preserved in the Hookerian Herbarium at Kew.

The Russian-American Fur Company planted a colony at Bodega in 1812, and in 1820 established Fort Ross, forty miles northward in the valley of the Russian River. They surrendered the territory in 1841, and left early in the next year. During this occupancy many botanical specimens were sent to St. Petersburg. Precisely how early these collections began, or who were the collectors, other than Wrangel and Wosnessensky, I have no information. But various Californian species were first described from specimens sent from this colony, or from plants grown in the botanic gardens of Europe from seeds collected here.

Baron (and Admiral) VON WRANGEL arrived at Bodega about 1829, and lived there as governor of the Russian Possessions in America. He spent a number of years here, and collected many plants and seeds, which were sent to the Botanic Garden of St. Petersburg.

DAVID DOUGLAS, a Scotch botanist, travelling under the auspices of the Horticultural Society of London, reached the Northwest Coast early in 1825. He botanized extensively in Washington Territory and Oregon, getting as far south as the Umpqua River, but not reaching the borders of California. On a second trip from England he again reached the coast early in 1830, and in December of that year came into California, where he remained botanizing from Monterey southward to Santa Barbara (May, 1831), and again northward to San Francisco and Sonoma County (38° 45′), returning to Monterey, and thence, in October, 1832, went by way of the Sandwich Islands to the Columbia. The next year he visited the Sandwich Islands, where he lost his life a few months later. His letters, giving an account of much of his travels in California and northward, may be found in the second volume of Hooker's "Companion to the Botanical Magazine." He collected nearly five hundred species in the State. An indefatigable collector, a close observer, and an enthusiastic traveller, he added more to the knowledge of the botany of the region than all the botanists who had gone before him. His Californian collections were chiefly

described in the supplement to the "Botany of Captain Beechey's Voyage," and those from Oregon and Washington Territory in Hooker's "Flora Boreali-Americana." Hooker's, Lindley's and Bentham's herbaria contain sets of his Californian plants, and many specimens are found elsewhere.

Dr. THOMAS COULTER, who collected in Mexico for many years, reached Monterey in November, 1831, and remained in Upper California until late in 1832 or possibly even longer (he was nearly three years in California according to Don), during which time he visited "all the habitable parts" of the country. The most notable of his excursions was one to the Colorado River in 1832. He left Monterey late in March, was at San Gabriel April 23, and at the ford of the Colorado River, just below the mouth of the Gila, May 8. He returned by the same route and was again at Monterey July 19. He was the first botanist to reach the interesting Colorado desert and Gila regions, and some of his species were not again found until very many years after. He collected more than a thousand species in Mexico and California; but they remained mostly undistributed and unknown until after the collector's death and the appointment of the late Prof. W. H. Harvey as curator of the herbarium of Trinity College, Dublin, which at that time, or previously, came into possession of them. Dr. Harvey published several interesting Californian genera and species, and distributed the duplicates of the collection, — the fullest set to the Hookerian Herbarium, and portions to the herbaria of Gray and of Torrey. The geographical results of his Californian explorations are published in a paper in the Journal of the Royal Geographical Society of London (1835), v. 59–70, with a map.

FERDINAND DEPPE, of Berlin (whose name is associated with that of Dr. Scheide in Mexico), visited California in 1831 or 1832. But his name is rarely met with in connection with Californian botany.

Several Californian species were described, by or before 1834, as having been collected by Mr. P. E. BOTTA, but I have no more definite information as to when or where he collected here. He was a travelling naturalist, collecting for the Museum of Natural History of Paris.

THOMAS NUTTALL crossed the continent in an expedition under Captain Wyeth, in 1834, to the Columbia River. Thence he went to the Sandwich Islands, and returned to California, where he collected during a part of the year 1835, mostly near the coast, from San Francisco to San Diego. His collections were very rich, and contained the types of many new species. Some of them are in the Gray Herbarium at Harvard University, and many in the herbarium of the Academy of Sciences at Philadelphia. They are also at Kew, and the original set was purchased by the British Museum after Nuttall's death. Descriptions appeared in various places, many being published in Torrey and Gray's Flora of North America; the new Compositæ were described by himself in the Transactions of the American Philosophical Society, 1841.

RICHARD BRINSLEY HINDS, surgeon on board the English surveying-ship *Sulphur*, under Captain Sir Edward Belcher, visited the State in the autumn of 1837, and went up the Sacramento River for some distance. In October and November, 1839, the expedition again touched the coast, and collections were made at San Diego, but chiefly southward at various points in Lower California, where no botanists had previously been. Some of these collections were made by Mr. BARCLAY, a collector sent out by the Royal Garden of Kew. The results were published in the "Botany of the Voyage of H. M. S. *Sulphur*," by Hinds and Bentham.

Dr. WOSNESSENSKY was sent, by the Academy of Sciences of St. Petersburg and the Zoological Museum of that place, to the North Pacific, and spent ten years on the coast. He spent some time collecting in California, but when he first came, how often or how long here, or how extensive his botanical collections were, I do not know. He was on Mount St. Helena June 12, 1841, which is the only date I have of his visit.

WILLIAM D. BRACKENRIDGE and Dr. CHARLES PICKERING, connected with the United States Exploring Expedition under Lieutenant Wilkes, visited California in 1841. They entered the State by land from Oregon, passed by the western base of Mount Shasta and down the Sacramento Valley to the Bay. Their Californian collection was small, but contained some very interesting species, an account of which was given by Dr. Torrey in the Botany of the Expedition.

M. DUFLOT DE MOFRAS, who was sent by the French government on an expedition to the west coast of North America in 1840 to 1842, was in California in 1841. How much he collected in this State it is not easy to say; but in an Appendix to his "Explorations du Territoire de Oregon des Californies," etc. (Paris, 1844), ii. 403, there is a catalogue of the principal plants of the Northwest Coast, which enumerates about two hundred and ninety species, without even the usual specific authorities, and with so many errors of one kind or another as to be of little scientific value.

Dr. WILLIAM GAMBEL, an ornithologist from Philadelphia, crossed the continent by way of New Mexico and Arizona to California, returning in 1843. He made a collection of plants, some of which were described by Nuttall in a paper entitled "Plantæ Gambelianæ," in the Journal and in the Proceedings of the Academy of Natural Sciences of Philadelphia for 1848. Nearly a hundred new species were described, of which a considerable part were collected in California south of Point Conception. But many of the plants described in this memoir were collected by Nuttall himself and not by Gambel.

Capt. JOHN C. FREMONT traversed the continent in 1843 by way of Great Salt Lake and Humboldt River, crossed the Sierra Nevada in midwinter, just south of Lake Tahoe, and entered California in February, 1844, descending the South Fork of the American River. Late in March he set out on his return, passed southward along the eastern edge of the great valley, recrossed the Sierra Nevada at Tehachipi Valley and Fremont's Pass, thence to the Mohave and Virgin Rivers, and eastward, taking with him the earliest collection that had been made in any portion of the Sierra Nevada Range. In the report of this expedition (usually known as his second expedition), Dr. Torrey described about thirty species and four new genera. On his next (or third) expedition of 1845 to 1847 he made much more extensive collections, but unfortunately many of the specimens were lost by an accident in the mountains. The specimens saved amounted to about six hundred numbers, and contained many new species, some of which were described by Dr. Torrey in "Plantæ Fremontianæ" in the "Smithsonian Contributions" for 1850.

THEODOR HARTWEG, a German botanist, was sent to Mexico by the London Horticultural Society in 1836. He collected in California in 1846 and 1847, making his headquarters at Monterey, but extending his excursions to the American and Yuba Rivers, the Sacramento as high as Chico, and in other directions. Over four hundred species from California were distributed to subscribers, enumerated by Bentham in his "Plantæ Hartwegianæ."

NORMAN BESTOR collected on Major W. H. Emory's expedition across the continent, joining the party at Santa Fé, and reaching San Diego December 12, 1846. In the report of the expedition Dr. Torrey enumerates one hundred and sixty species as especially worthy of mention, of which number less than thirty are cited as having been collected in California.

Rev. A. FITCH travelled extensively in California about 1846 to 1849, and sent several collections to Dr. Torrey, including some species of much interest. Most of the specimens were from the southern half of the State.

This closes the period of Spanish occupancy, and brings us to the second period, beginning with the great immigration of 1849. Dr. C. C. PARRY, connected with the Mexican Boundary Survey, arrived at San Diego in July, 1849. The first collections made on two trips across to the Colorado River were lost in the transit east. Between March, 1850, and March, 1851, he made extensive collections, all of them south of Monterey.

Prof. GEORGE THURBER, also connected with the Mexican Boundary Survey, reached the State late in 1851 and botanized within our borders until July, 1852. A few specimens were collected as far north as San Francisco, but the most of his collections were made in the southern part of the State, between the coast and the Colorado River. Descriptions of some of his new species were published by Dr. Gray in "Plantæ Thurberianæ."

Dr. J. M. BIGELOW and Messrs. ARTHUR SCHOTT and CHARLES WRIGHT also collected plants on this survey, but their collections were all made east of our borders. The two former gentlemen, however, collected later in the State. The enumeration of the collections of all the botanists connected with the survey was published together in the Report upon the Botany of the Mexican Boundary.

Dr. ALBERT KELLOGG came to San Francisco in 1849, and still lives there. During this more than thirty years he has collected along the coast from Alaska to San Diego. Some of his specimens are in the herbarium of the California Academy of Sciences, and others are scattered in various directions. He has described many new species, and no name is more intimately associated with the botany of the State during this period. At a later date (1868–69), in connection with W. G. W. HARFORD, he made extensive sets of Californian and Oregon plants for distribution.

Dr. J. D. B. STILLMAN collected plants in 1849 near Sacramento, and in 1850 between Marysville and Long Bar. The specimens are in the Torrey Herbarium.

Dr. HENRY BEHR came to San Francisco in 1850, and has since lived there. He has collected from time to time, particularly before 1860, some of his specimens going to local collections, some to Hamburg, some to Russia, and elsewhere.

Dr. GEORGE GIBBS was on this coast from 1848 until 1860. From 1849 to 1854 he was most of the time in this State, where he made some collections, mostly near Columbia. Later, he

made more extensive collections in Oregon and Washington, which were in part incorporated with the collections of Drs. Cooper and Suckley and with those of the Northern Boundary Survey.

WILLIAM LOBB was in the State from 1850 to 1853, collecting seeds and specimens for Mr. Veitch of Exeter, England, and through him many interesting species reached Europe.

GEORGE BLACK, an engineer, made collections near Yuba River about 1850, some of which went to England along with the collections of Mr. Lobb, and others were sent to botanical correspondents in Scotland.

Dr. T. L. ANDREWS made considerable collections, mostly near Monterey, beginning about this time and extending over several years. Some went to the California Academy of Sciences, some to Dr. Torrey, and Dr. Newberry had others.

Dr. G. E. HULSE collected some plants in the northern part of the State about 1850 and sent his specimens to Dr. Torrey.

Dr. A. WIZLIZENUS made a small collection in the State in 1851, but his more extensive and better known collections were made earlier beyond our borders.

Dr. N. J. ANDERSSON was on the Swedish frigate *Eugenie* in her voyage around the world and collected in California in 1852.

Mr. A. F. BEARDSLEY collected for Lawson & Co. of Edinburgh about 1852 to 1854, and probably for others later. He collected seeds rather than specimens.

Mr. JOHN JEFFREY, a Scotch gardener, collected both plants and seeds in the northern part of the State and in Oregon, in 1852–53, for subscribers to the "Oregon Botanical Expedition" of Edinburgh. Considerable confusion grew out of the various supposed new species of his collection and the manner of their publication by the "Oregon Committee."

Mr. H. G. BLOOMER came into the State in 1852 and for many years made collections as opportunity offered. Many of his specimens went to the herbarium of the California Academy, some came into the collections of the State Geological Survey, some were sent to Professor Gray, and others went into various herbaria.

WILLIAM A. WALLACE collected plants about Los Angeles in 1854 and later, and sent his specimens to Professor Gray.

During the years enumerated, several persons are mentioned in the publications of the California Academy as sending plants to its herbarium, some of which were described as new. Among these names are Col. L. RANSOM, from various localities; Mr. A. PEABODY, from Russian River; Mr. GARVITT, from Placerville; Mr. C. D. GIBBS, from the Sierra Nevada, near the head of Carson River, and others.

Many specimens were collected within the State from 1853 to 1855 by botanists connected with the Pacific Railroad Explorations. The largest of these collections was made by Dr. J. M. BIGELOW, under Lieutenant Whipple, the entire collection from Arkansas to California amounting to about twelve hundred species, of which over eleven hundred (excluding Cactaceæ and Mosses) were enumerated in Vol. IV. of the Pacific Railroad Reports. These plants, as well as those of the other government expeditions, were determined chiefly by Dr. Torrey and Dr. Gray, and the specimens are to be found in their herbaria and in the National Herbarium at Washington. They were also partially distributed to foregn herbaria, especially to those at Kew and St. Petersburg.

Dr. A. L. HEERMANN collected in the central valley of the State in 1853, in connection with Lieut. R. S. Williamson's survey, and perhaps later. About one hundred species were noticed by Durand and Hilgard in Vol V. of the Pacific Railroad Reports. He was in the State about three years.

Prof. WILLIAM P. BLAKE, geologist upon the same survey, also made a botanical collection in Southern California, which was described by Dr. Torrey in the same volume, together with plants collected about Fort Yuma by Major THOMAS and Lieutenant DU BARRY.

Dr. J. S. NEWBERRY collected under Lieutenants Williamson and Abbott, mostly in Oregon and Northern California. Over five hundred species were reported by him from this region. He also collected on the expedition under Lieutenant Ives, in 1857–58, along the Colorado River, and through Northern Arizona.

Dr. THOMAS ANTISELL was connected with the party under Lieutenant Parke and collected in 1854 in Southern California. About two hundred and eighty species are enumerated in his Report.

Dr. JAMES A. SNYDER was with the party under Lieutenant Beckwith, and collected in 1854 between Salt Lake and the Sacramento River. The Report includes only about sixty species, of which but few were collected within this State.

The other collectors upon this series of explorations did not reach our State, but several army officers stationed in the State made local collections, among which may be mentioned that of Dr. J. F. HAMMOND, at Fort Reading, in 1853.

CHARLES WRIGHT made a small collection about Benicia, Mare Island, and vicinity, while connected with the North Pacific Expedition under Captain Rodgers, in the winter of 1855–56.

Gen. AMOS B. EATON made a collection of ferns about the Strait of Carquinez in 1855, and the specimens were distributed by Prof. D. C. Eaton. The number of species was small, but some were new to the State.

THOMAS BRIDGES came to California in 1856, and for the next nine years collected on the coast, much of the time in this State, his collections going mostly to Europe. After his death, in 1865, his wife presented the California collections then on hand to the National Herbarium at Washington. They were distributed by Dr. Torrey.

L. J. XANTUS DE VESEY collected at Fort Tejon in 1857–59 for the Smithsonian Institution, and Dr. Gray published a list of one hundred and twenty-two species.

In 1860 the State Geological Survey, under Prof. J. D. Whitney, was organized, and began field work in November of that year. In connection with this survey, WILLIAM H. BREWER collected from 1860 to 1864, and was the first to botanize to any considerable extent in the high Sierras. FRANCISCO GUIRADO in 1860 and 1861 collected with the party, mostly south of Monterey. Dr. J. G. COOPER collected in 1860–62 at Fort Mohave and elsewhere. Dr. EDWARD PALMER collected at San Diego in 1861. HENRY N. BOLANDER began his collections in the State in 1863, which were continued for some twelve years or more, a part of the time in connection with the State Survey, and were very rich and extensive. Dr. GEORGE H. HORN, of the United States Army, made collections in 1862–64 at Camp Independence in Owen's Valley and at Fort Tejon, and placed his collections at the service of the Survey. WILLIAM HOLDER collected about a hundred species around Oakland in 1863. Dr. WILLIAM HILLEBRAND, of Honolulu, visited the State the same year and made considerable collections, mostly in the Sierra Nevada, a part of which he placed in the State collection. Mr. V. RATTAN collected near Placerville in 1863, and again in the Sacramento Valley in 1866, and placed duplicates in the collection of the Survey. Dr. H. M. CRONKHITE, U. S. Army, made a small but interesting collection in the Klamath Valley in 1864. Other persons also contributed smaller numbers of specimens, the collections of the Survey from these various sources reaching some eight thousand numbers.

Dr. CHARLES L. ANDERSON, formerly of Carson City, Nevada, collected in that vicinity and on the eastern slope of the Sierra Nevada, 1863–66, then came into California, where he has since lived and has further collected, mostly in the region about Santa Cruz. A list of his Nevada collections, many of which were sent to Dr. Gray, was published in connection with the Report of the Nevada State Geologist in 1870.

HORACE MANN, JR., visited the State in 1864 and again in 1865, collecting in the two visits about three hundred species, which are now in the herbarium of Cornell University.

Dr. JOHN TORREY was here in 1865, most of the time at Santa Barbara, also crossing the Sierra into Nevada, and, as usual, detected many interesting species.

Prof. ALPHONSO WOOD in 1866 traversed the State from San Diego to Oregon, and made a considerable collection.

Dr. GEORGE L. GOODALE made a small collection of plants in the same year.

Prof. S. F. PECKHAM collected also in 1866 between three and four hundred species in the valley of the Santa Clara River.

[To supplement the above list, it is a pleasure here to make especial acknowledgment of those who by their contributions have aided essentially in the preparation of this Botany of the State. As the frequent recurrence of their names through the two volumes shows, there are several ladies to whom very much is due. Prominent among these are Mrs. MARY E. PULSIFER AMES, of Auburn, and Mrs. R. M. AUSTIN, of Prattville, Plumas County, who, during several years, have collected zealously in the northern Sierra Nevada, and have added largely to our knowledge of the flora of that region. Mrs. A. P. BARTLETT, of Bartlett Cañon, near Santa Barbara, Mrs. JOHN BIDWELL, of Chico, Mrs. A. E. BUSH, of San Jose, Mrs. ELWOOD COOPER, of Santa Barbara, and Miss SARA A. PLUMMER, also of Santa Barbara, have all made collections of value, and with scarcely an exception have contributed new species to the flora of the State. Among the other collectors no one has been more enthusiastic or successful than Mr. J. G. LEMMON of Sierraville, who has botanized through a large part of the northern Sierra Nevada and in the desert region of the northeastern part of the State, as well as in Southern California, between Santa Barbara and

the Sierras, and especially in connection with Dr. C. C. PARRY in 1878 about San Bernardino and the borders of the adjacent desert. Dr. EDWARD PALMER has visited California several times, making very valuable collections in the southern borders of the State and northward to the Mohave region and along the coast to Monterey, as well as on Guadalupe Island and through Western Arizona. Rev. E. L. GREENE made small collections, but including many novelties, about San Francisco and northward, and especially in Siskiyou County. Mr. VOLNEY RATTAN, of San Francisco, has collected in the Coast Ranges, northward to the Oregon line; as also Mr. G. R. VASEY, of Chicago, who visited the State to make specimens, especially of woods, for the Centennial Exhibition. Sir JOSEPH D. HOOKER and Dr. ASA GRAY were in California in 1877, visiting Monterey, the Yosemite Valley, and Mount Shasta. In Southern California, Mr. D. CLEVELAND, of San Diego, has communicated much of interest respecting the plants of that place, of especial importance as the region where Nuttall had found many species. Dr. J. T. ROTHROCK, in connection with Lieutenant Wheeler's survey, collected between Santa Barbara and the head of Kern River. Mr. S. B. PARISH and Mr. W. G. WRIGHT at San Bernardino, and Rev. J. C. NEVIN at Los Angeles, have all interested themselves in the botany of their localities, and gathered as opportunity offered, as has also Dr. W. MATTHEWS, U. S. Army, stationed at Camp Independence in Inyo County, and afterwards at Camp Bidwell in the northeastern part of the State.

Mention should also be made of those whose collections, though not made within the State, have been from so near its borders as to be of importance in showing the range of many California species, and especially as indicating what species may still be expected to be discovered. Such are the collections made in connection with Lieutenant WHEELER'S survey in Arizona and Nevada, by Dr. PALMER and Dr. PARRY in Arizona and Southern Utah; and by Mr. W. W. BAILEY and SERENO WATSON in Northern Nevada upon the survey of the 40th parallel under CLARENCE KING, while in Oregon very important collections have been made by E. HALL in 1871, and more recently by Rev. R. D. NEVIUS of The Dalles and Baker City, and Messrs. JOSEPH and THOMAS J. HOWELL of Willamette Slough, and in Washington Territory by Mr. W. SUKSDORF, at White Salmon, and Mr. W. C. CUSICK, of Union. — S. W.]

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